SEP 29 1944

Medical Library

Archives of PHYSICAL THERAPY

Official Journal American Congress of Physical Therapy

EDITORIAL BOARD

WALTER M. SOLOMON, M.D.
Cleveland, Ohio.
(On leave of absence, Army U. S.)

EARL C. ELKINS, M.D.
Rochester, Minn.

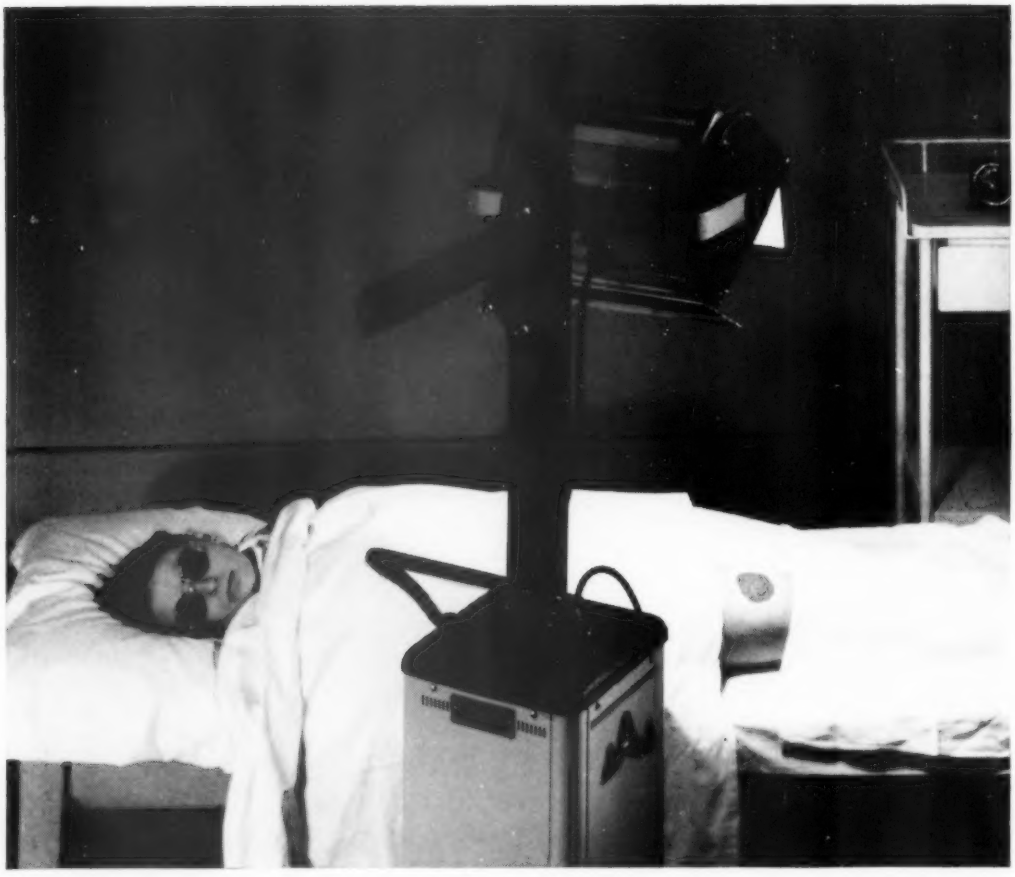
FRED B. MOOR, M.D.
Los Angeles, Calif.

RICHARD KOVACS, M.D.
New York, N. Y.

ARTHUR L. WATKINS, M.D.
Boston, Massachusetts.
(Interim appointment.)

JOHN S. COULTER, M.D.
Chicago, Ill.

Volume XXV SEPTEMBER, 1944 No. 9



FOR ULTRAVIOLET RADIATIONS OF MAXIMAL BIOLOGIC EFFECTS

Because ultraviolet therapy today is based on scientifically established technics according to the various sources of ultraviolet radiations, every physician has a means of correctly evaluating and efficiently administering this form of energy.

With this guiding information, you can readily determine the potential therapeutic range of G.E.'s latest designed ultraviolet lamp, *Model G.* Equipped with the well-known *Uviarc* mercury-vapor quartz burner, this lamp's characteristic emissions are in the spectral region of maximal biologic effects, and therefore the most direct and logical approach to the desired clinical results.

Designed specifically and exclusively for the profession, the G-E Model G Lamp assures you of every requisite to ultraviolet therapy according to the latest approved technics.

Write today for full details. Ask for Pub. H19.

GENERAL ELECTRIC X-RAY CORPORATION

2012 JACKSON BLVD. CHICAGO (12), ILL., U. S. A.

Today's Best Buy – U. S. War Bonds

Contents—Sept. 1944

Volume XXV No. 9

ARCHIVES OF PHYSICAL THERAPY

30 North Michigan Avenue, Chicago 2, Illinois

Original contributions, exchanges and books for review should be forwarded to the Editorial Office. All business matters including advertising should be handled through the Executive Office, 30 N. Michigan Ave., Chicago 2, Illinois. The statements in the manuscripts published in the ARCHIVES OF PHYSICAL THERAPY, are made solely on the responsibility of the author. The American Congress of Physical Therapy does not assume any responsibility for statements contained therein. Manuscripts accepted for publication in ARCHIVES OF PHYSICAL THERAPY, are for exclusive publication and may not be published elsewhere.

OFFICERS

American Congress of Physical Therapy

MILAND E. KNAPP, M.D.,
Minneapolis, President.
WALTER S. McCLELLAN, M.D.,
Saratoga Springs, N. Y.
President-Elect.
*H. WORLEY KENDELL, M.D.,
Chicago, First Vice-President.
*O. LEONARD HUDDLESTON, M.D.
Denver, Colo., Second Vice-President.
EARL C. ELKINS, M.D.,
Rochester, Minn., Third Vice-President.
ARTHUR L. WATKINS, M.D.,
Boston, Fourth Vice-President.
ROBERT L. BENNETT, M.D.,
Warm Springs, Ga., Fifth Vice-President.
RICHARD KOVACS, M.D.,
New York, Secretary.
JOHN S. COULTER, M.D.,
Chicago, Treasurer.
WALTER J. ZEITER, M.D.,
Cleveland, Executive Director.
MARION G. SMITH, B.Sc.,
Chicago, Executive Secretary.

EXECUTIVE COUNCIL

Kristian G. Hansson, M.D., New York, *Chairman.*
*Norman E. Titus, M.D., New York, *Secretary.*
William Bierman, M.D., New York.
John S. Coulter, M.D., Chicago.
James C. Elsom, Madison, Wisconsin.
Roy W. Fouts, M.D., Omaha, Nebraska.
John Severy Hibben, M.D., Pasadena, Calif.
Abraham R. Hollender, M.D., Chicago.
Disraeli Kobak, M.D., Chicago.
Frank H. Krusen, Rochester, Minnesota.
Fred B. Moor, M.D., Los Angeles.
Nathan H. Polmer, M.D., New Orleans.
William H. Schmidt, M.D., Philadelphia.
Frederick L. Wahrer, M.D., Marshalltown, Iowa.
Miland E. Knapp, M.D., Minneapolis, Ex-Officio.

EDITOR EMERITUS

DISRAELI KOBAK, M.D.,
Chicago.

* In Active Service.

Subscription — In the United States, its possessions, and Mexico, $5.00 yearly; Canada, $5.50; elsewhere, $6.50 the year.
Advertising ratse on application. All advertising copy subject to acceptance by publication committee.
Published monthly at Chicago, Illinois, by American Congress of Physical Therapy.
Entered as Second Class Matter, January 29, 1938, at the Post Office at Chicago, Illinois, under the Act of March 3, 1879.

ORIGINAL ARTICLES

Education in Physical Medicine..Miland E. Knapp, M.D. 517

Naval Medicine with Special Reference to Physical Therapy ..... Luther Sheldon, Jr., Rear Admiral, (MC), U. S. N. 522

New Horizons in Physical Medicine.....David Grant, Major General, U. S. A., The Air Surgeon 525

A Rehabilitation Center for the Injured Worker. ....John S. Coulter, M.D. 529

Some Physiologic Effects of Passive and Active Exercise. I. The Cardiovascular Response to Graded Exercises .....E. Corinne Fries, M.S. 540

Some Physiologic Effects of Passive and Active Exercise. II. Training Effects on the Strength of Specific Muscle Groups.....E. Corinne Fries, M.S. 546

Diagnostic and Therapeutic Massage..... .....Harold D. Storms, M.D. 550

Grading of Spasm in Infantile Paralysis..... .....J. Wayne McFarland, M.D., and Dorothy A. Graves, B.E., R.P.T.T. 553

•

Awards 556

•

Editorials 557

•

Medical News 561

•

Book Reviews 565

•

Physical Therapy Abstracts 568

•

EDITOR OF MONTH

RICHARD KOVACS, M.D.

New York, N. Y.

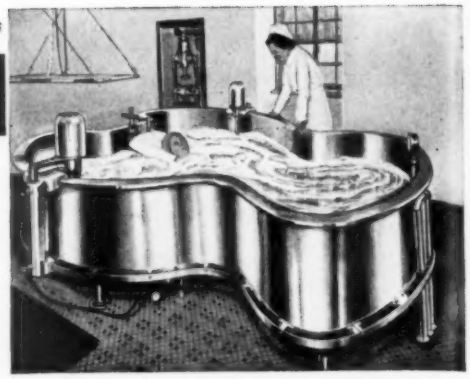
Printed in U. S. A.

Spectacular Results

in Hydrotherapy

TWO OUTSTANDING UNITS

Each With THERMOSTATIC CONTROL

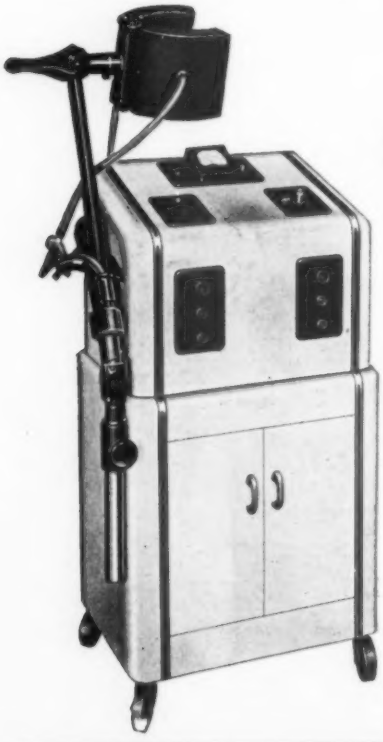


Excellent, and at times spectacular, results have been obtained with the Ille Improved HYDROMASSAGE SUBAQUATHERAPY TANK (for full body immersion) in the rehabilitation of the paralytic, in the after care of fractures, in orthopedic surgery of the extremities, and for functional improvement in arthritis.

And equally good results have been obtained with the Ille PORTABLE MODEL (IMPROVED WHIRLPOOL BATH)—a combination Arm, Leg and Hip Tank requiring no plumbing job to install and easily moved—which is strikingly effective in reducing pain and disability from traumatic injuries, sprains, contusions, synovitis, bursitis, burns, infections, etc.

You cannot afford to be without these two indispensable units—used so extensively by government, civilian and industrial hospitals.

ILLE ELECTRIC CORPORATION
36-08 33rd STREET, LONG ISLAND CITY, N. Y.



LF

SHORT WAVE DIATHERMY AVAILABLE SOON

Your new short wave diathermy unit can be the moderately priced Model SW-221 (illustrated at left) with the time-saving, adaptable HINGED Treatment Drum—or the Dual Wave Model SW-550 which provides every known diathermy treatment modality including air-spaced plates and HINGED Treatment Drum.

Write today for details. Place your order early for fall delivery.

THE LIEBEL-FLARSHEIM CO.

303 West Third St., Cincinnati 2, Ohio

Presidential Address

EDUCATION IN PHYSICAL MEDICINE *

MILAND E. KNAPP, M.D.

CLEVELAND, OHIO

Physical medicine this year finds itself beset by the most violent growing pains of its entire existence. After years of struggling in the dim obscurity of hospital basements and of valiantly trying to win through the barriers of doubt and distrust that had been firmly fixed in the minds of the majority of physicians, physical medicine has suddenly emerged into the bright sunlight and as a result is being subjected to microscopic dissection by the medical profession and the lay public alike.

We, as members of the American Congress of Physical Therapy, must be prepared for this sudden interest, must be ready to prove the value of physical methods wherever possible, and must be eager to support the present trend toward investigation of physical methods in the light of fundamental as well as clinical research.

Spotlights have been focused on us from four different directions. First, the medical services of the armed forces have become aware of the value of physical treatment in the care of casualties of all types, so that they are insistently demanding a large number of physical and occupational therapy technicians and nonexistent physician specialists in physical medicine for the Army and Navy. Rehabilitation is the topic of the day, and rehabilitation centers have sprung up like mushrooms throughout the country. In response to these demands, the number of schools for physical therapy technicians has been nearly doubled in the three years that we have been at war. Special emergency training courses have been established which condense the didactic courses into six months instead of the usually required nine to twelve months. Even these measures have not been sufficient to fulfill the demands, however, so that there is still a great scarcity of technicians.

To those of us who are looking with interest toward the future of physical medicine, however, the most stimulating development is the training of several hundred medical officers through courses in physical medicine of three months' duration at several cooperating centers of instruction. These men will most certainly serve as a vital nucleus for the advancement of understanding of physical medicine among the medical practitioners throughout the United States when they return to civil life after the war has ended. In addition, a certain number of them will undoubtedly be stimulated to remain in the specialty in civilian life. They will serve to increase interest in physical treatment and may in time help to solve some of our problems.

Second, the National Foundation for Infantile Paralysis has for some years been sponsoring both teaching and investigation in several fields of physical medicine. It has recognized that adequate care of the poliomyelitis patient is not possible without the help of trained physical therapy technicians. Therefore it has aided the programs of established schools and has encouraged the establishment of new schools for training of technicians in addition to setting up extensive programs of research in fields of physical therapy associated with the problems of poliomyelitis.

Third, the Baruch Committee has recently conducted an extensive survey

* Presidential Address delivered at the Twenty-third Annual Session of the American Congress of Physical Therapy, Cleveland, September 6, 1944.

of existing facilities and needs for teaching and research in physical medicine. As a result, Mr. Baruch has given large sums of money to several institutions to further long term research projects in physical medicine and to improve the teaching of physical medicine to undergraduate and graduate physicians.

Fourth, lay publications have been devoting more space to the subject of physical medicine. On several occasions recently I have picked up the rotogravure section of a newspaper to find pictures of whirlpool baths and of technicians giving massage and other therapeutic procedures, usually in Army or Navy Hospitals. Magazine articles are frequently devoted to the subject of rehabilitation and occupational therapy. This publicity tends to make the public conscious of physical medicine and is creating a demand for this type of treatment. It is not uncommon for our colleagues to refer a patient to us because of the insistence of the patient himself.

Is medical education keeping pace with these developments? A few years ago it was stated that the medical student seems to be guarded against knowledge of physical therapy much as children are guarded against knowledge of the facts of life. As a result of this attitude, which has been maintained until very recently, there are many thousands of practicing physicians who have only a superficial knowledge of physical methods. These men are now called on to prescribe physical treatment. The results are often ludicrous. The usual result is that some faint-hearted attempt is made to give a prescription in general terms, such as "physiotherapy" or "light treatment," that can be interpreted by the technician as she sees fit. Yet frequently the very man who examines a patient and then makes out an order reading, "Mrs. John Jones: Diagnosis—pain in the neck; treatment—'physiotherapy'", and sends the patient to the physical therapy department, where the technician must decide on the actual treatment, would be the first to criticize in violent language any physician who would examine a patient and then make out a prescription reading, "Mrs. John Jones: Diagnosis—tuberculosis; treatment—'medicine'", and send her to the drug store for the druggist to decide what should be given. Yet he is doing an exactly comparable thing.

In our department any order which comes in for "light treatment" is brought to me. I usually then call the man who gave the order and ask him what he wanted given, ultraviolet or infra-red ray and how much. Frequently the answer is, "Oh, either one. Whichever you think is best." In other words, the physician doesn't even know that there is a difference. It seems incomprehensible to me that any one should order a treatment about which he knows absolutely nothing.

This condition is of course the result of ignorance and of lack of training by our medical schools.

I had the following experience several years ago. One of the prominent internists in our hospital decided that a patient needed an emergency infra-red ray treatment on a Sunday afternoon. Of course there was no technician in the department on Sunday afternoon, and I was not available at the moment. So his blood pressure rose a few points and he pushed an ultraviolet lamp from the department to the patient's bedside to give this half-hour infra-red ray treatment himself. The circumstance that saved him from making a serious error that might easily have resulted in a malpractice suit was that he was unable to light the lamp because he did not know about tilting the burner. Otherwise he would have given his patient a half hour of ultraviolet ray therapy with a lamp that has a minimal erythemal dose of one minute at 30 inches. When he found that he could not light the lamp, his blood pressure rose still higher, but he finally gave up and departed, muttering remarks about our "rotten equipment."

This experience could have been avoided by more adequate undergraduate and graduate training in physical medicine.

As a matter of fact, this story gives a most pertinent illustration of the appalling lack of instruction in the elements of physical medicine during an otherwise excellent training in internal medicine. It is true, although it may seem like heresy for me to be saying it, that there is really only one excuse for the existence of physical medicine as a specialty. That excuse is the fact that the complexity of equipment and methods makes it difficult for the general practitioner, surgeon, internist or other specialist to learn enough about physical medicine to employ it intelligently in his practice.

This statement is, of course, equally true with respect to the specialty of roentgenology and also, I suppose, as applied to many other specialties.

However, physical and occupational therapy consist of diagnostic and therapeutic procedures which should be part of the armamentarium of every physician. The general practitioner should certainly know enough about these subjects to use some of the simpler procedures intelligently in his daily practice and, furthermore, should be sufficiently well trained to realize when help is needed so that he may call for consultation before his case has become so bad that a satisfactory result is impossible or can be obtained only after long and strenuous treatment. This statement is even more true of the specialist than of the general practitioner. Every surgeon, internist, ophthalmologist, laryngologist, orthopedist, dermatologist, urologist, neurologist, psychiatrist, gynecologist and, yes, even every obstetrician, should be trained just as thoroughly in the physical methods useful in his specialty as he is in medical or surgical methods.

This is unfortunately not the general situation at the present time. Except in orthopedics, dermatology, urology and occasionally in psychiatry, physical methods are generally ignored, and even in these specialties full use of physical possibilities is not usually made.

How can we best set about to overcome this most deplorable situation? It has been stated in the Baruch report that the preeminent need is for "more teachers of physical medicine." At present there are not enough trained teachers of physical medicine to staff a quarter of the medical schools of the United States. Therefore, it is obviously impossible to correct the situation by employing more teachers.

The more feasible solution at the present time in my opinion is to interest one or more members of each clinical department in the phases of physical medicine pertaining to his specialty, prevail on him to study the possibilities and practice them until he becomes sufficiently familiar with them to assist in the teaching of the subject to others. This might be done by subsidizing the clinical department in such a manner that this member could spend half of his time in physical medicine. This has been said by one of our preclinical professors to be the only feasible plan. Or the same purpose might be accomplished by rotating the fellow through the physical therapy department for some months during the course of his fellowship. This education of the developing specialist in the types of physical medicine pertinent to his field is one of the most important phases of education in physical medicine because the more a physician knows about a subject the more often and the more intelligently will he use it in the treatment of his patients. This will serve more than any other one thing to increase interest in physical medicine.

The education of the undergraduate medical student in physical medicine should not be neglected. At the present time many medical schools have no

provision for instruction of the medical student in any of the phases of physical medicine. A few have had short lecture courses for some years, but very few provide for any clinical practice. The number of schools giving some form of instruction in physical medicine to undergraduates has been definitely on the increase in recent years, I am happy to say. However, difficulties in obtaining trained medical personnel and in finding time for additional courses in the crowded medical curriculum have served to limit the amount of instruction given. Improved instruction of medical students and especially the addition of some clinical practice in physical medicine should be one of our aims at this time.

Graduate training for the purpose of developing clinical specialists in the field of physical medicine is in its infancy but will be one of the major developments in the near future. At the present time only three institutions are approved for residencies or fellowships in physical therapy. They are the Mayo Foundation, Michael Reese Hospital and Stanford University Hospital. Thus far only two candidates have received their master's degree in physical therapy from the University of Minnesota. The Baruch Committee is planning to subsidize fellowships in physical medicine as soon as there are candidates available. Much of this may necessarily have to wait until the war is over, however.

This problem of graduate training in physical medicine is intimately connected with the problem of the development of teachers and investigators in the field. The development of competent research workers in both the fundamental and clinical branches of physical medicine is absolutely necessary for the continued progress and growth of the specialty. It is obvious that much fundamental research must be done by physiologists, biophysicists, anatomists and pathologists. Some teachers have gone so far as to state that the head of the department should be a laboratory-trained research worker. With this I cannot agree. If a clinical department is to function efficiently and progress satisfactorily, it should be headed by one who is primarily a clinician. Fundamental laboratory training would be desirable, of course, but the training should be primarily clinical and the interest should be primarily in physical medicine. There should, however, be a strong fundamental research division of the program so that analysis of procedures, effects and technics could be made on sound scientific bases. However, one should not lose sight of clinical effects, but should rather try to explain them. Much of the present day training of physicians in medical schools is impractical for the reason that the very purpose of fundamental training is defeated when the student is not provided with sufficient transition from fundamental to practical and is thus forced to learn his practical medicine in the school of experience rather than in the school of medicine.

It would appear advisable to establish in each medical school a chair of practical medicine and to place in it a successful older and experienced practitioner with only a moderate scientific training but with a large fund of practical knowledge.

However, for a really adequate teaching program the clinical and fundamental sides should both be represented on the teaching staff, and the more men that can be interested in the various phases of the subject the better will be the results.

The discussion of teaching of physical medicine so far given does not include training of the large mass of physicians who have already graduated from medical schools or have received advanced training in various specialties without an adequate knowledge of physical medicine. They should be reached in some way. I have had numerous requests from practicing physicians to give

them instruction in physical therapeutic procedures because they realized after getting into practice that something important had been omitted from the curriculum of the medical school. This instruction would need to be condensed into a short period of time and offered repeatedly. The feasible methods seem to be the offering of short courses at one of the centers of continuation study, the giving of talks on physical medicine at county medical society meetings and hospital staff meetings and the training offered in the study courses at these annual meetings of the American Congress of Physical Therapy.

With improvement in training of physicians, there will inevitably follow improvement in the training of technicians. It is extremely difficult to teach students something that you really do not thoroughly understand yourself. At present we are handicapped by insufficient accurate knowledge of the physiologic effects of many physical procedures. They have necessarily been taught in an empiric manner. Personalities have often crept into treatment technics and have been perpetuated there by repetition and the apprenticeship type of training usually employed.

We must strive to establish scientific foundations for the application of therapeutic modalities wherever possible and to eliminate those procedures which do not stand up under rigid scrutiny. Procedures may be standardized to a certain extent but should never be standardized to the point where they become "routines" to be followed regardless of changes in the patient's condition either physical or mental.

However, I have great faith in the physical therapy technician. I have never found a group more anxious to learn, more interested in its patients or more wholeheartedly devoted to the advancement of ideals.

I am sure that the technicians will absorb anything good that we have to offer and will use it to the best of their ability in furthering the interests of the patient. The problem of improving technician training, then, really boils down to the problem of improving our own knowledge so that we have more information to impart to them.

In addition to the usual type of course consisting of the addition of a year of training in physical therapy to a background of nursing or physical education, I should like to see more general adoption of a regular four year university course starting with high school graduates and providing a well rounded education leading to a bachelor's degree in physical or occupational therapy. Such courses have already been established in three schools.

I believe an important organizational advance has been made in the adoption by the American Medical Association of the term "physical medicine," which includes physical therapy, occupational therapy, spa therapy and rehabilitation. We can all pull together now for the establishment of an American board to certify specialists in "physical medicine."

Summary and Conclusions

Physical medicine is now presented with the greatest opportunities as well as the greatest responsibilities of its history. In order that the opportunities may be utilized to the greatest advantage, and the responsibilities may be discharged to the greatest benefit of all, we of the American Congress of Physical Therapy must do everything in our power to further research and education in physical medicine.

On research both clinical and fundamental depends progress and development. We have only recently reached the level where preclinical research workers are willing to devote their energies to our problems. This is a healthy sign which indicates a bright future for physical medicine. Improvement in knowledge and improvement in teaching for the undergraduate, graduate and postgraduate physician and the technician alike must follow.

NAVAL MEDICINE WITH SPECIAL REFERENCE TO PHYSICAL THERAPY *

LUTHER SHELDON, JR., REAR ADMIRAL, (MC), U. S. N.

It really gives me much pleasure to be with you and to have the privilege of bringing you the greetings of Vice-Admiral McIntire, the Surgeon General of the Navy. He, and all of us in the Medical Department of the Navy, are greatly interested in that specialty of Medicine of which most of you here tonight are disciples and practitioners. We realize its worth and wish we had among our Naval Medical Officers more men and women who were experts in its application. Thanks to the patriotism of American Medicine, we have some of your members who have joined our forces at considerable financial sacrifice. Through their help, we hope and expect to accomplish much.

But, it is not my intention to talk to you only about the things those who practice your specialty may accomplish in making even better the fine record already established in World War II by the medical officers of our armed forces. We are proud of our record up to this time and have no reason to fear that it will become less creditable as the war draws nearer to its successful conclusion.

In December of 1941, the Navy had about 1,000 medical officers. Today, it has approximately 12,000, far short of the number needed to fill with adequacy the billets, afloat and ashore. We hear much about the long hours worked by those physicians who have remained in civilian practice and the shortage of physicians in many communities. We know this picture is not overdrawn, but we also know that if it were not for the willingness of medical officers of the armed forces to work without thought of hours, and frequently without rest over long periods, the results that have been accomplished in the care of the sick and injured would have been impossible. And, please remember, the vast majority of the physicians who are doing this fine work in the Navy were, just a short time ago, practitioners in your town and mine.

Most of you probably know that the Medical Corps of the Regular Navy is composed of men who are graduates of recognized schools of Medicine, most of whom join the Navy because they like it and wish to make it a career shortly after they have completed their interneships and before they have had a chance to concentrate on any one specialty. In spite of this, the Corps is a corps of specialists. After a young man has been in the Navy a few years, he knows pretty well what specialty he wishes to follow. Some prefer general surgery, others, internal medicine, ophthalmology, otolaryngology, urology, neurology, x-rays, anesthesia, or some other specialty. Some, I am pleased to say, choose Physical Medicine, and I feel sure that more will do so in years to come as this specialty gains the place it should hold in the art and science of Medicine. Opportunity for study and practice of specialties is made available for those of our officers who show sufficient aptitude to justify it, both in civilian institutions and in our own hospitals. These men are allowed to practice their specialty, and among them we believe we have many who can hold their own with specialists in their lines among civilian doctors. However, we never allow these men to forget that they have one specialty above all others, that of Naval Medicine. They must never become so highly specialized that they cease to be physicians, nor

* Address of Welcome delivered at the Twenty-third Annual Session of the American Congress of Physical Therapy, Cleveland, September 7, 1944.

must they overlook the fact that as they become older in the service and higher rank comes to them, they must become administrators of hospitals and other medical facilities.

Please bear in mind that I have been talking about the physician who has chosen the Navy as his career. I am not speaking of the Reserve Officer who enters the Navy in time of national emergency because his patriotism urges him to do so. Many of these men already have their specialty and, so far as is possible, are assigned to duty where their special training will be of the greatest value. However, I think I am right when I say that, when through necessity, they are required to perform duties outside of their specialty they profit from such duty and will be better physicians when they return to their home communities because of their experiences.

This war has demonstrated that early treatment of casualties is essential. Early treatment means treatment at the scene of injury, rapid evacuation to some sort of aid station, then further evacuation to a hospital equipped and staffed to give definitive treatment. But, it is largely the treatment at the front, consisting chiefly of morphine, splinting, and the administration of plasma or serum albumen in sufficient quantity to overcome shock that has made possible the splendid record of less than 3 per cent of deaths among the seriously wounded in this war, as compared with more than 8 per cent in World War I. And we should remember that this early treatment is not, as a rule, administered by high-class specialists. It is most often given by young physicians freshly out of medical school and internship and, frequently, by enlisted men of the Hospital Corps, all of whose training has been received in the Navy. This is a group for which we should be thankful and of whom we are very proud.

Unfortunately, physical wounds of battle are not the only casualties of this war. Various diseases have laid low many men in our training centers; tropical diseases have played havoc with some of our forces in the Pacific; and, last but not least, neuropsychiatric casualties are not rare. These are casualties of war as truly as gunshot wounds or injuries received in air battle. They may not stir our emotions so strongly, but their victims are just as much entitled to our best care as are the physically wounded.

Wounds, physical illnesses, and mental disturbances of all degrees present a challenge to us. It is one that we must meet, and you who specialize in Physical Medicine can do much to help.

Those of you who are attending the Scientific Sessions of this American Congress of Physical Therapy have heard something of the Rehabilitation Program of the Navy, and will hear more. The purposes of this program, as you have been told, are (1) to return men to duty physically and mentally sound and (2), where it is evident that a member of the naval forces will never be fit to return to duty, to see to it that he or she is returned to civil life in fit condition to earn a decent and honorable living.

Where should Rehabilitation begin? My thought is that for military needs, it should begin at the Induction Center, even before the man is sworn into military service. If, through careful study of psychiatrists and physical examination it can be determined that an inductee is liable to become a casualty even before he enters combat he should not be inducted but should be informed of his lack of aptitude, the peculiarities in his mental or physical make-up which account for this, and directed by his examiners into the right civilian channels for correction of his defects. Some will profit and some will not, but, the effort is worthwhile. Those who profit will become better citizens; those who do not, will not necessarily become wards of a benevolent government, and many of them will be able to carry on in subordinate, but useful positions in civil life.

If I may leave the war out of the picture, I should like to say that

for the good of the nation, Rehabilitation should begin long before a boy or girl reaches the age of induction or enlistment into the military services. It should begin in the home in the earliest formative period and should be continued in the primary schools, through grammar and high school years, and college, too. I think all of us must agree that it is a disgrace for any nation to have more than 30 per cent of its youth come up for induction and be rejected because of physical or mental defects. Yet, this has been the experience of America in this war, as shown by statistics of the Selective Service System. There can be but one answer, neglect of those things which make for better manhood. These include proper discipline in the home and physical and psychologic training in our schools. Correction of this situation is within our power and no group of medical people is in a better position than you to accomplish it. Do not think for one instant that I am confusing Physical Medicine with Physical Culture. Such is not the case, but specialists in Physical Medicine and qualified practitioners of Physical Therapy should be among the leaders in guiding our youth along the path to physical health. In spite of all we can do, there will be insane minds in sound bodies, but the greatest guarantee we can have of a sane mind is a sound body.

Today, we are in the midst of the greatest war in history and, while the end is not yet in sight, we have reached that stage in which we have many men returning home with injuries of all kinds. It is our duty to see that the effects of these injuries, be they physical or mental, shall be minimized and not allowed to build up in our midst a group composed of hundreds of thousands of veterans who feel that they are unfit to take their rightful places in industry, trade, and the professions because of their war experience. Most of them, if properly handled, can be returned to civilian life better fitted to carry on than they were when they went to war. The danger is that some may not be properly handled and will become the victims of well-meaning but poorly-directed efforts towards rehabilitation and end up as useless wards of the government, satisfied to be fed three square meals a day and occupy a comfortable bed at night in some institution provided for them by the tax payers. In spite of all our efforts, there will be many of these, among them some who could not possibly be rehabilitated, but it should be our effort to hold this number to a minimum.

In the Navy's rehabilitation program we have been somewhat handicapped by the lack of specialists in Physical Medicine among our medical officers and a dearth of trained physical therapists in our Hospital Corps. Thanks to your organization and the efforts of the recognized schools for Physical Therapy Technicians, we believe that our needs will be met and that we need have no fear of this part of our program being a failure.

In our planning, Occupational Therapy has been included as an integral part of Physical Therapy and we are developing it as rapidly as facilities may be made available. Through splendid cooperation on the part of the leaders in the field of Occupational Therapy we are being supplied with many qualified workers.

Physical Therapy plus Occupational Therapy, together with diagnostic skill and all that goes to make a good physician are combined in the science of Physical Medicine. Physical Therapy is too narrow a term for your specialty and I predict that the action of the American Medical Association in changing the name of its council which deals with your problems to the Council on Physical Medicine will have far-reaching effects and attract to your ranks many able recent graduates in Medicine.

The Navy's Rehabilitation Program is under way. It has already accomplished much. It will accomplish more. That it will be a success, we know, but the path will be made smoother if we may count on the wholehearted assistance of you who are leaders in the field of Physical Medicine.

NEW HORIZONS IN PHYSICAL MEDICINE *

DAVID GRANT, MAJOR GENERAL, U. S. A.

THE AIR SURGEON

Speaking before the members of the American Congress of Physical Therapy is a genuine pleasure. For the past twenty-two months the Air Forces has conducted a Convalescent Training Program, designed to engage the sick soldier in a program of activity in which physical medicine in all of its aspects has played a most important part.

I believe it appropriate indeed at this time to discuss the Air Forces Convalescent Training Program and the part which physical therapy and physical medicine have played. As soon as our patient is over his acute stage of illness, the rehabilitation or reconditioning process is begun. In most instances this might mean forty-eight hours after a patient is post-operative. More than 30,000,000 man hours of experience has given us many guide-posts and pointed the way to ever-increasing technics and improvements.

The Air Forces program has four facets on which the approach to the soldier patient is based. These are (1) physical, (2) psychologic, (3) vocational, (4) resocialization. In all of these phases the staff of the hospital operates as a team, with the Flight Surgeon acting as captain. The captain of this team like the captain of any good football team can turn out a winning combination only in direct proportion to the cooperation and skill employed by the other members.

Emphasis in the early stages of recovery is on the physical side and lies with the physical therapist and the physical reeducation staff. With the improved condition of the patient, it passes to the academic instructor and the director of vocational guidance. Then all team up with the psychiatrist, the psychologist and other trained workers to send the soldier back to duty in the best possible physical and mental condition. If the soldier does not go back to duty, but rather returns to civilian life, then we believe it important that great emphasis be placed on his proper reorientation or resocialization.

On the physical side, every effort is made to awaken the will of patient to recover, to exert every effort on his own behalf. The physical therapist plays a major role in this. The use of new and ingenious methods which will increase patient interest are important and encouraged.

The basic philosophy of our treatment of the soldier-patient in the convalescent program is that the patient must be taught to help himself. There is no substitute for the patient's will to aid in his own recovery. This means that the physical therapist must be more than a mechanical workman. It means, also, that our physical education personnel must be more than mere "muscle men." They must be both educators and counselors. Physical medicine must be carried to the individual patient in need of corrective work as part of his education. We do not believe that the job is one of simply carrying out a prescribed routine. We are educators, and this is our approach to the soldier-patient.

The soldier who wiggles his toes and moves his ankle while the leg is enclosed in a cast is taught a little anatomy. The results of toe wiggling are made evident to him in language he understands. The soldier who does

* Address of Welcome delivered at the Twenty-third Annual Session of the American Congress of Physical Therapy, Cleveland, September 7, 1944.

deep breathing, arm and shoulder or other exercises is taught the whys and wherefores of what happens to his body. This individualized and personalized treatment is one of the foundation stones of recovery.

By a series of graduated exercises the soldier-patient's strength is increased and when he is discharged from the Air Forces hospital he returns to duty in top physical condition. It is a little difficult for the average person to understand the difference between the military and the civilian hospital. From the military hospital the soldier must return to a full regime of duty. From the civilian hospital the patient may be told to go home and "take it easy for a few days." Certainly he won't be on long marches, bivouacs or maneuvers the day he is out of the civilian hospital. But he might, and often does, the day he is discharged from the military hospital. For this reason it is essential that the soldier be discharged to duty in top physical condition. The challenge to the physical therapist in this situation is obvious.

In the rehabilitation of returning combat casualties, the physical therapy departments of our Air Forces convalescent hospitals play an ever increasingly important part. While often these departments appear to be straight line production systems, our insistance on the preservation of the principle of individualized treatment and care is maintained throughout. The soldier is a name and an individual to us no matter how busy we may be or how many treatments must be given. The physical therapist acts in direct conjunction with the Flight Surgeon who is the soldier-patient's family doctor during his entire stay in the convalescent hospital.

The psychologic phase of our convalescent treatment is most interesting and important. A patient in ill-health is usually more receptive to suggestion than one in good health. Everything is done to stimulate hope and self reliance in the patient. The combat casualty is taught to look on himself as a normal man no matter what his disability. The psychologic approach of the physical therapist must be in enlarged and advanced terms. He should be prepared to discuss the needs of the whole man in all of the things which are inherent in daily living. Teaching how to walk properly, how to use prosthetic devices, making the fullest use of the amputated limb, retraining paralyzed or atrophied muscles, the most effective actual work projects to which particular disabilities will respond, are part of the whole picture. We cannot be said to have effected any cure unless a soldier-patient walks out of our hospitals fully convinced in his own mind that he knows all of the "tricks of the trade" in terms of his disability. This knowledge will help him to lead a full and normal life. Only a soldier who has been so physically and psychologically reconditioned can be returned to society as a normal individual.

The vocational phase of the AAF Convalescent Training Program plays a role that is not only essential but most practical. A large number of hospitals provide woodworking and other shops for patients. AAF Convalescent Hospitals dealing chiefly with casualties provide shops of more varied types. Metal working, arc welding, automotive, sheetmetal work, electrical and radio shops are a few examples. Here the patient with a disability is given work projects which will be good therapy for him and at the same time enable him to build constructively. It enables him to test his skills while actually developing certain muscles. It gives him confidence in his ability to do things as he sees the end project, something tangible, grow under his own power. It provides him with short work experiences which will assist him in choosing his future work. Dexterity can be redeveloped by various ingenious shop devices and technics. Every advantage is taken of the most modern means. But we do not stop there. At each of the AAF

Convalescent Hospitals there are present Vocational guidance officers. These men, working with the soldier-patient make every effort to determine what the soldier is best fitted for, in an army job first, and, if the soldier is to be discharged, in a civilian occupation. What does the soldier want to do? What can he do in terms of his disability? How can we best guide him? What information can we give him concerning the old occupational field to which he would like to return, or to a new one. What are his prospects for the future? These are all questions for which our vocational guidance officers help to supply the answers.

The resocialization of the wounded soldier is not an overnight job. It requires careful handling. But the results achieved are well worth it. It is our policy as stated by the Commanding General of the Air Forces, General H. H. Arnold, to give the soldier as much personal attention as is humanly possible. General Arnold has said that the responsibility of the Army Air Forces for its personnel will not end when the bombs are dropped over the target. To us this means that the soldier will be restored to society in the proper frame of mind and in the best possible physical condition. To accept the full responsibilities of citizenship he must be re-oriented to his environment in the most intelligent and common sense manner. The soldier is normalized by a series of doctor-patient talks. He is spoken to frankly and speaks frankly in return. The end result has been generally good.

It will readily be seen that in the accomplishment of all of the objectives which I have set forth as our plan for sick and wounded soldiers, that team work is absolutely essential. The doctor, the physical therapist, physical vocational guidance and educational officers and education personnel must all cooperate for the treatment of the whole man to achieve maximum results.

The AAF Convalescent Training Program has had some excellent results as evidenced by important statistics which have been gathered. With men discharged in top physical condition, hospital readmissions have been reduced, military education has been continued during convalescence as the heretofore idle time of the patient is utilized to the fullest extent. Convalescence time has been shortened and in the majority of cases, sick leave or furloughs have been eliminated.

In certain acute and contagious diseases hospital time has been materially reduced through this convalescent training program. In one of our hospitals, careful records were kept of the physical condition of patients at the time of discharge from the hospital. Using the Army Air Forces physical fitness test as a base, we found these men indicated a better physical condition by approximately 5 per cent, than the non-hospitalized men at the same post. Numerous research tests conducted by Dr. Peter Karpovich at the AAF School of Aviation Medicine, using cadets from the San Antonio Aviation Cadet Center have indicated that definite measurable results have been achieved from convalescent training. At Ft. George Wright, one of our Convalescent hospitals at Spokane, Washington, ninety per cent of the combat casualties from overseas return to some kind of duty within the Army Air Forces. In one of our hospitals with a large number of neuropsychiatric cases, these patients were given an active physical activity program ranging from calisthenics to recreation of every type. The program also included a number of courses, educational and military in nature. Prior to the inauguration of this program, forty-one per cent of the neuropsychiatric patients required sedation. Within a short period after the physical and educational activity was made part of routine treatment of the neuropsychiatrics, this figure dropped to three per cent. Here is concrete proof of the value of this type of active program for neuropsychiatric patients.

Other statistics could be quoted to indicate the beneficial results of the

AAF Convalescent Training program. But that all important intangible which does not lend itself to figures, morale, cannot be proved by a mere recital of statistics. Our program has had tremendous impact in this direction. Men who were formerly bored and inactive are now interested and busy. The soldier no longer has time to brood over his imaginary complaint or magnify his personal problems. His mind and body when usefully and constructively occupied heal much more rapidly.

Permit me to illustrate this with a quotation from the Commanding Officer of the AAF Convalescent Hospital at Fort George Wright.

"Even though our soldier-patients are worked harder and do not have the liberties, such as passes and furloughs which are usually granted during convalescence, they are much happier and, strangely enough, our disciplinary problems are almost nil. The convalescent wards have been organized to run themselves and maintain their own discipline and local government which seems to give the necessary responsibility and build morale."

I have touched on the basic philosophy of the Army Air Forces Convalescent Training Program. The size and scope of the problem presented by sick and wounded soldiers cannot be minimized by us. We continue to seek improvement through self evaluation and suggestions which come from persons who are experts in the field. Physical therapy and physical medicine have played a prominent role in the Air Forces program. Its importance will increase as time goes on.

New subscriptions and changes of mailing address are being handled as rapidly as possible. The central office requests your patience in this regard.

A REHABILITATION CENTER FOR THE INJURED WORKER *

JOHN S. COULTER, M.D.

CHICAGO, ILLINOIS

Rehabilitation is the planned attempt through the use of all recognized measures under skilled direction to restore those persons who because of disabilities do not assume as quickly as possible that place in the productive stream of society which they are potentially capable of assuming.[1]

The first step in rehabilitation is to obtain the cooperation of the patient and awaken his will to recover. After this cooperation has been obtained, rehabilitation will be the result of coordinated activity by a team of experts in medicine, surgery, orthopedic surgery, psychiatry and physical medicine. The part to be played by physical medicine in such activity has grown tremendously in recent years.

The Liberty Mutual Insurance Company, which writes a substantial volume of workmen's compensation, recently established a rehabilitation center in Boston. Mr. S. Bruce Black, president of the company said in explanation:[2] "Our experience had been that there was considerable difficulty in bringing about full recovery—restoring the worker to a working status—in some cases. Our rehabilitation clinic, a pilot clinic, was an effort to find a remedy for this situation." After the clinic had been in operation for a year, Mr. Black was of the opinion that rehabilitation should be begun as soon after the injury as possible. This would mean the establishment of facilities for rehabilitation in our American hospitals.

Aitken[3] has shown the value of the Boston clinic in the proper coordination of orthopedic surgery and physical, occupational and recreational therapy. The floor plan of this rehabilitation center, which is capable of caring for 50 patients daily, is shown in figures 1 and 2.

Lieut. Col. Raymond Hussey, formerly chairman of the Board of Occupational Diseases of the Maryland Department of Labor and chairman of the Committee on Workmen's Compensation of the Council on Industrial Health of the American Medical Association, stated:[4] "It is unfortunate, I think that physical and occupational therapy clinics are organized separately from hospitals, since we all realize that physical and vocational rehabilitation procedures should be given simultaneously with medical and surgical treatment."

A general hospital engaged in vocational rehabilitation should have a physical medicine department consisting of physical and occupational therapy departments. The Office of Vocational Rehabilitation of the Federal Security Agency stated: "In the selection of hospitals, it is desirable to give preference to hospitals larger than 100 beds, with well-developed surgical and specialty services, medical social service, physical therapy and occupational therapy departments."

Many general hospitals have arranged for the proper location and coordination of their physical and occupational therapy departments. Such coordination by the Massachusetts General Hospital has been described by Watkins.[5] At St. Luke's Hospital in Chicago the physical and occupational therapy departments have worked together for years. Most private general

* Read at the Twenty-third Annual Session of the American Congress of Physical Therapy, Cleveland, September 7, 1944.

hospitals will soon need a department of physical medicine to carry out the federal-state program for crippled children and the federal-state program of physical and vocational rehabilitation and to treat properly many of the persons injured in civilian industry.

The Liberty Mutual Insurance Company recently gave to Northwestern University Medical School a grant for creating teaching clinics on the subject of rehabilitation of the injured worker. With part of this grant the occupational therapy department at St. Luke's Hospital is to be enlarged

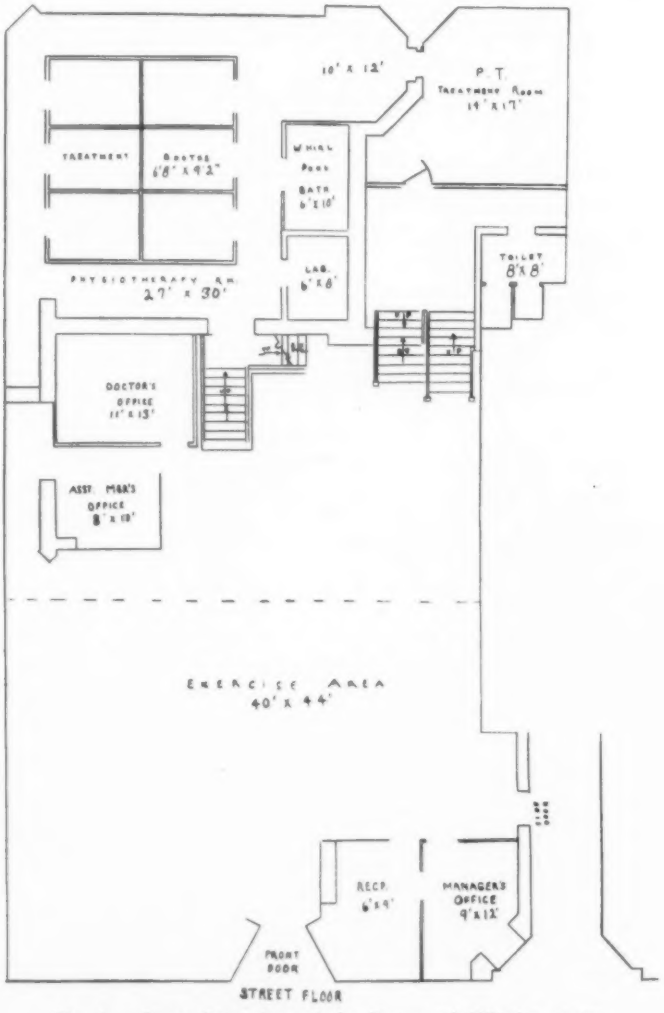


Fig. 1. — Street floor plans of the Boston rehabilitation center.

so that it will be able to give to 25 patients a day the type of rehabilitation that is given in the Boston rehabilitation center.

Essentials of Successful Physical Therapy

The adequacy of physical therapy depends on efficient personnel, proper equipment, good location and coordination with an occupational therapy department. It is realized that the present war must terminate before physicians specializing in physical medicine can be secured to head such departments.

In regard to physical therapy technicians, the Office of Vocational Rehabilitation of the Federal Security Agency stated:

In reviewing and approving State Standards for the designation of physical therapists, the Office of Vocational Rehabilitation will be guided by the State Agency's utilization of the following criteria:

(*a*) Registration in the American Registry of Physical Therapy Technicians (30 N. Michigan Ave., Chicago 2, Ill.)

(*b*) Graduation from schools for physical therapy technicians approved by the Council on Medical Education and Hospitals of the American Medical Association.

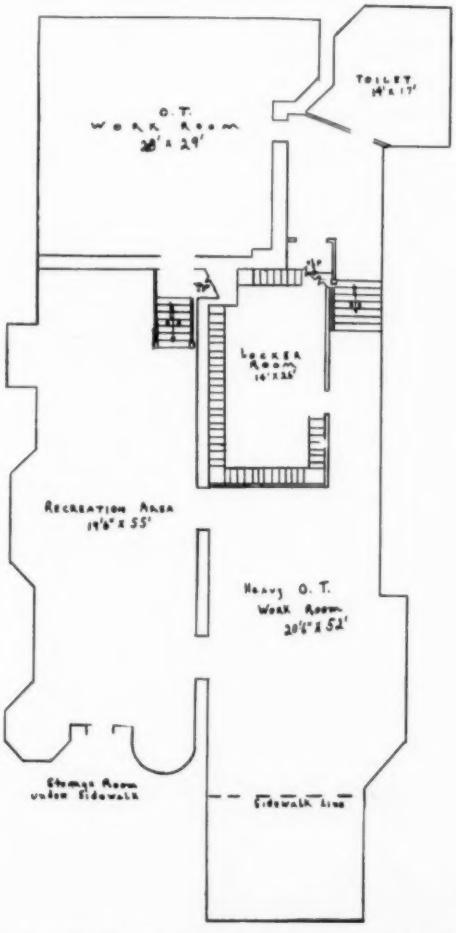


Fig. 2. — Basement floor plan of the Boston rehabilitation center.

The list of these schools can be found in *The Journal of the American Medical Association*, March 25, 1944.

Physical therapy should be started early in vocational rehabilitation, and this is only possible with safety if the physical therapy technician is properly trained. For instance, it is stated in "An Outline of the Treatment of Fractures":[6]

When functional disabilities are not caused by failure of union or bony deformity, or direct nerve or vascular lesions, they result from fibrosis in the soft parts due to organization of the condition produced therein at the time of fracture and intensified by prolonged or extensive immobilization of joints and muscles. They can be minimized by early removal of as much of the condition as possible through physical ther-

apy in the first ten days, by as little immobilization of joint and muscles as is possible without interfering with the immobilization of the bone fragments, and by as much active exercise of joint and muscle as can be obtained throughout the course of the healing of the fracture. In any given case the method or methods which most nearly carry out these requirements will produce the best convalescence and better functional end results.

Early physical therapy means treatment by heat, massage and exercise while the patient is still in bed—before he can be moved to the physical therapy department. And it must be remembered that physical therapy does not stop with the application of heat or diathermy. Its real value is established through exercise. In an agency or physician's office which deals solely in the application of infra-red ray lamps, it must be considered that physical therapy is not practiced.

All the apparatus in a physical therapy department should be of types approved by the Council on Physical Medicine of the American Medical Association. This Council publishes yearly a free booklet "Apparatus Accepted." Accepted apparatus has been examined and tested by the Council for lack of danger and for proper performance.

That a physical medicine department cannot be considered adequate unless it is coordinated with occupational therapy can be illustrated in the treatment of injuries. The ordinary physical therapy given to a patient lasts, at the most, only an hour, and the exercises have definite limitations. The human body is more than a machine, and the formal repetition of a movement either with or without an apparatus is not of maximum therapeutic value in increasing the amount of movement in a stiff joint or as an integral part of a larger coordinated movement, because there is no psychologic stimulation to personal incentive or sustained effort.

Essentials of Successful Occupational Therapy

The adequency of an occupational therapy department depends on efficient personnel, proper equipment, coordination with physical therapy and good environment.

Every hospital can afford to follow the standards of occupational therapy personnel set by the Office of Vocational Rehabilitation:

(*a*) Registration in the Registry for Occupational Therapists (American Occupational Therapy Association, 175 Fifth Avenue, New York City).

(*b*) Graduation from a school for occupational therapy technicians approved by the Council on Medical Education and Hospitals of the American Medical Association. The list of such schools can be found in *The Journal of the American Medical Association* for March 25, 1944.

It is important that the occupational therapy workshop have environmental conditions which are better than the patient's normal environment (fig. 3). If the patient in such a workshop can be surrounded with a feeling of well-being beyond that to which he is accustomed, a great deal has been accomplished. This end is achieved by proper decoration of the workshop, orderliness and absolute cleanliness. For a patient to leave the ease and lazy surroundings of his personal environment requires a considerable effort, and he can be stimulated to this effort by the arousing of his desire to be in the workshop.

The type of occupational therapy should be prescribed by a physician, for the successful application of such therapy demands a thorough knowledge of physiology, pathology and bodily mechanics. While work may be desirable merely to improve the mental condition, it can be prescribed, for example in orthopedic cases, so that it will in addition actually exercise the muscles, tendons, etc., that need toning for complete recovery.

A similar point to be considered is that both physical therapy exercises

and occupational therapy should be such as will tone the muscles which the patient will use when he returns to his regular work. Suppose, for example, that a man who is employed in handling a shovel is being treated for a broken leg. To be sure the muscles of the leg will need strengthening. But at the same time those of the arms, shoulder, back and stomach must not be neglected. There would be no sense in sending the man back to work with his leg cured but his back weak.

Fig. 3. — Workshop, illustrating many industrial conditioned reflexes and a good shop environment, Boston rehabilitation center.

In the curative workshop, power reduction factors, such as psychologic inhibitions, pain, fear and fatigue, are eliminated as much as possible.

Pain is lessened by cooperation of the hospital staff and the physical therapy department. The advantage of having the curative workshop near the physical therapy department is apparent. By the use of heat, diathermy, the whirlpool bath, massage and muscle stimulation pain is diminished and exercise is facilitated.

Fear should be eliminated by cooperation of the occupational therapy technician and the patient's employer. The physician in charge of a department of physical medicine and the occupational therapy technicians should not give testimony on the patient's condition for the insurance company or the employers before a court or the workmen's compensation board. Once this is done, the news spreads that the department is trying to get the patient to work not to benefit the condition but to prove to the insurance company that he can work. This causes fear in all patients and a loss of confidence in the workshop.

The necessity of guarding the patient against fatigue is another reason for having occupational therapy prescribed and supervised by a physician. The patient should be cautioned that no form of work or play should be continued for more than a relatively short time. Fatigue can be measured in the arm by a hand grasp strength test and in the leg by a pull test for the quadriceps muscle. It may be mental as well as physical, and for this reason a curative workshop should have recreational therapy and exercise classes.

Purpose of Recreational Therapy

Recreational therapy often can be arranged through competition to give the desired exercise. Figure 4 shows a dart game arranged to give abduction and rotation of the shoulder.

Though recreational therapy provides diversion—a mental rest from the workshop—and may also provide desirable exercise, it is most important in contributing to the social readjustment of the patient. It has been found that in the treatment of injured men social accomplishments come first. Though a long time is spent training a man vocationally, if he is not able

Fig. 4. — Dart game, showing method of giving shoulder abduction and rotation in a game.

to achieve his proper place socially he will never be a rehabilitated patient. He must acquire ease in conversation with his fellows and ability to play the types of games that are accepted. Games are played with the technician and are handled in such a way as to encourage the patient to excel, so that he will gain confidence and ease.

To cite an example: A man with an artificial hand came to the rehabilitation clinic. Though we were able to get him to use that hand and arm to saw wood, hammer nails and do a pretty good job in the woodworking shop, he was not at ease, and when the hand was not in use he kept it in his pocket. Not until he found that he could excel at the pool

table did he realize that even with such a hand he was the equal of other people. That social accomplishment played an important part in his future.

An essential for rapid rehabilitation is a hopeful attitude on the part of the patient. The chronic patient depends on the physical and occupational therapy technician for help in the restoration of function. Early exercise and diversional occupational therapy often prevent a state of mind in which the patient is liable to become resigned to inactivity. In rehabilitation, physical medicine must put put the responsibility of rehabilitation on the patient, while making it possible for him to accept this responsibility.

Psychotherapy in Convalescence

Often the patient has a psychologically protracted convalescence and it is necessary to use psychotherapy. In the physical medicine department of St. Luke's Hospital, Solomon's[7] method is used in such cases.

Solomon does not ask the physical therapy physician to be a psychiatrist or to assume responsibility for the complete psychotherapeutic management of a patient, but he does think that physical therapy is often psychotherapeutic in character. Obviously patients will not all react to the psychologic factors in physical therapy in the same way, and it is often desirable to emphasize different psychologic factors. Solomon believes therefore that in certain cases the psychiatrist should write orders for the guidance of the physical therapy technician so that the patient's reactions can be controlled. Some of these orders are: 1. Show a great deal of interest and attention. Many patients who have a psychologically protracted convalescence are persons who had felt themselves rejected prior to the accident. 2. Treat the patient in a friendly manner. Reward progress with enthusiastic praise. A patient may break down during convalescence because his desire to be friendly with his associates or with the attending personnel has been frustrated. 3. Accept the patient's regressive trends. The desire to rest, to be taken care of, to be supported, to be protected is latent in every one. After an injury, a person in whom this desire is marked has an adequate reason for accepting care because he is more or less helpless. The technician in following this order will administer treatment to the affected part with as much gentleness and caution as she would if an organic interference with function were present. 4. Maintain an authoritative attitude. Some persons are essentially passive and prefer to be led. After an injury which produces a relative degree of helplessness they welcome authoritative attitudes on the part of the attending personnel. The ultimate goal in the management of such patients is the stimulation of aggressive feelings. 5. Invite the patient to cooperate. There are certain patients whose personality has prominent passive tendencies but who protect themselves against being dominated. They will be unduly sensitive to authoritative attitudes. They should be taken into the confidence of the technician about all treatments so that they may feel that they are on the same level as the technician. 6. Do not call attention to the patient's improvement. Many patients seek encouragement as to recovery but, paradoxically, they become angered on being told that they are improved, because this is to them a withdrawal of recognition that they are ill. 7. Carefully avoid any implication that the patient is suffering from anything but organic disease or injury. Some patients, sensing that their symptoms are not organic, are extremely sensitive to implications to this effect. 8. Give encouragement, allay anxiety and give assurance. Many patients will be sent to the physical therapy department by the psychiatrist because they need additional reassurance. These are patients who face difficulties of readjustment to civilian life, who are apprehensive about the extent of their injuries or who have been discouraged

and depressed by actual lack of therapeutic progress. Solomon warns that sympathy should be expressed cautiously, as it may serve to intensify anxiety. 9. Be unusually kind and considerate to the patient. Permit him to tell all his experiences or not as indicated. Industrially injured patients suffering from acute fright neurosis after a terrifying accident may have a compulsive tendency to talk in great detail.

The Industrial Conditioned Reflex

In the treatment of the injured workman in the curative workshop, Griffiths'[8] observations on the conditioned reflex of industry should always be remembered. He said in part:

> The conditioned reflex adds the power-producing factor of repetition, and this in the deliberately acquired reflex was originally the result of conscious effort. Impulsive action, although not a true acquired conditioned reflex, is produced by the cortical memory of deliberate action freed by practice from the psychological inhibitions associated with conscious deliberation. Deliberate action becomes an effort of will power or thought; but for deliberate muscle action to be developed into a state of skilled muscle action a period of training is necessary, requiring concentrated mental effort and practice, and this can only lead to the desired skilled action as experience is obtained. Finally, something more is needed before the skill becomes expert. This extra something is not only experience but represents a definite advance in pure psychical effort.
>
> The inhibition of the conditioned reflex may be either external or internal. The external inhibition is produced by some excitatory processes other than the conditioned stimuli in the central nervous system, and of these pain, the anticipation of pain or other fear, are of greatest importance.

Griffiths advocates occupational therapy because the conditioned reflexes of industry are so complex. For example, when a skilled carpenter uses a saw, the action is one of pushing and pulling the saw, but long practice has produced a conditioned reflex, so that each stroke of the saw corresponds almost exactly with the previous and the succeeding stroke. The reflex developed is a nice example of negative successive induction; it is not a simple affair of alternate contraction and relaxation of the biceps and triceps muscles or of the serratus magnus and latissimus dorsi muscles. To mention a few of its components: In the saw hand, a definite tactile discrimination is associated with the saw. Since every workman uses his own tools, the same part of the skin of the hand is stimulated every time the carpenter grips the saw. In addition, there is the stimulus of bone vibration set up by the wavelength of the saw being used. The further the saw is thrust the shorter the vibration wave, until ultimately it is suggested that the reflex action of the thrust shall be reversed. There is also the sound reflex, the rasp of the saw, the note altering with the progress of the saw through the wood.

In considering industrial conditioned reflexes Griffiths claims that one must bear in mind the law of summation of conditioned reflexes. This states that when different conditioned stimuli call forth similar reflexes, they will produce a greater effect when acting together than when acting alone. A conditioned reflex, though it may be reduced, will not be lost by interference with one of the conditioned stimuli, provided the remaining stimuli are strong enough to overcome the inhibiting effect of the ones that are lost.

Most injured workmen can and should receive ambulatory treatment, and this must be designed to insure that they use their conditioned reflexes and so secure the maximum amount of exercise with the minimum amount of fatigue. Man's ordinary walking gait is a combination of postural reflexes with the stepping reflex and various conditioned reflexes.

According to Griffiths, vocational exercise, that associated with the pa-

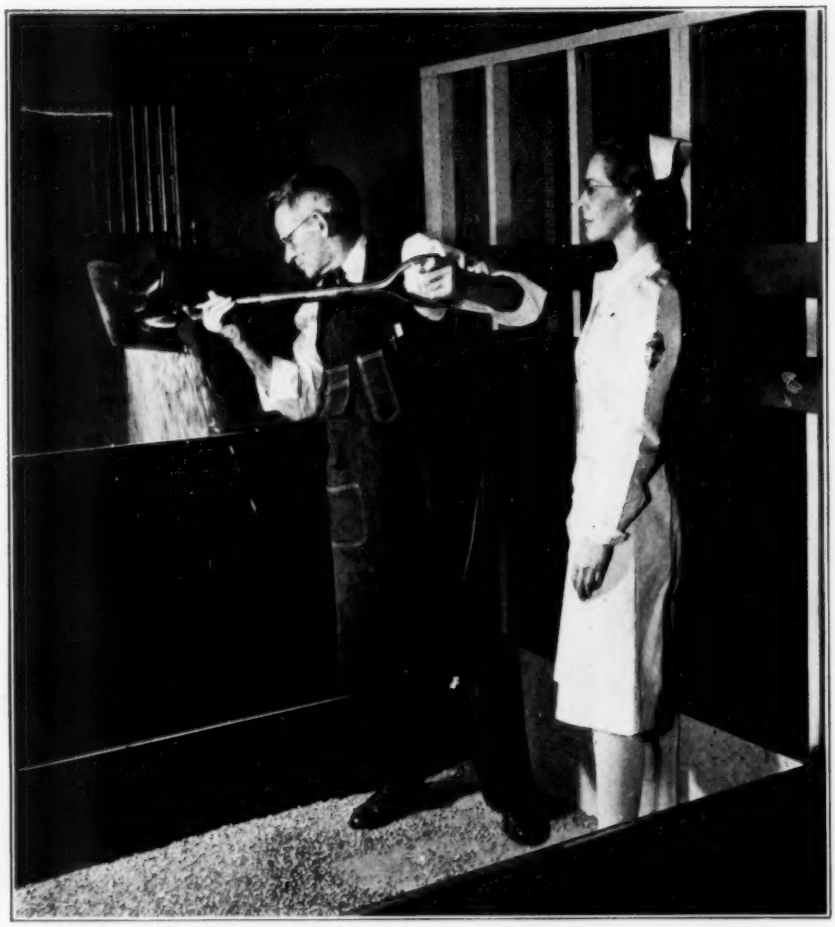


Fig. 5. — Industrial conditioned reflex of shoveling gravel over a fence adjustable in height, Boston rehabilitation center.

tient's work, must not be attempted too soon. For example, suppose that a carpenter who has an injured wrist is asked to use a screw driver. Driving a screw is for him a conditioned reflex, but the first turn of the screw is accompanied with pain. The movement now becomes a conscious one, and the anticipation of the pain produces a static contraction of muscle to resist the anticipated movement. It has been a mistake to attempt to restore the conditioned reflex before the arm was relatively free from pain and stiffness, which would inevitably inhibit the desired action.

Griffiths states also that if a patient is given so-called "light work" in his own trade before he is sufficiently free from pain and while he is still liable to early fatigue, there develops an inhibition of his previously work-conditioned reflexes, leading to increased clumsiness and to despondency. If he is not employed at the lighter forms of his old job but is given less skilled work in the same trade, one of his worst fears is realized. His mind now becomes so concentrated on the injured part that subconscious use of it almost becomes impossible and the most rapid road to recovery—restoration through exercise—is barred to him.

The rehabilitation center in Boston provides occupational therapy to restore industrial conditioned reflexes. Figure 3 demonstrates this in the wood-work shop. Figure 5 shows a laborer shoveling gravel over a board

fence adjustable in height. The patient in figure 6, who will return to work which is carried on from an adjustable scaffold, is shown pulling a rope which runs over a compound pulley. The weight in the bag can be increased as his shoulder and arm muscles gain power.

Restoration of Limb Function

Doran[9] recently analyzed the problems and principles involved in the restoration of limb function after injury. He stated that the foundation of such rehabilitation in the absence of complicating factors is restoration of the muscular power of the limb until it is capable of gradually stretching the adhesions responsible for the limitation of movement or of providing a good functional result when, owing to the pathologic conditions concerned,

Fig. 6. — Industrial conditioned reflex of pulling on a weighted rope as on an adjustable scaffold.

the restoration of mobility is impossible. He emphasized Roux's theory of functional adaptation, according to which a muscle will develop only those characteristics which are necessary to the work it is called on to do. A muscle if trained to overcome a great resistance will develop power enough to do so, but this will not improve its endurance, which is improved by its contracting against a small constant resistance over a long period. For example, when a man raises a 10 pound weight 1 foot in the air by flexing

his elbow, his elbow flexors perform 10 foot pounds of work. He could also perform 10 foot pounds of work by lifting a 1 pound weight 1 foot ten times. The first activity involves power and the second endurance.

In discussing active resistive exercises Doran showed that these are localized and controlled as they should be and that the more generalized, active, free-swinging exercises fail to restore the muscle power on which the function of the limb depends. In analyzing the restoration of limb function after a fracture of the humeral shaft, he showed that muscular power is unimportant for the restoration of movement provided there is no serious fibrous obstruction to be overcome. In his cases it was demonstrated that the power of the limb can be restored provided the elbow permits a total range of 70 degrees. He brought out three important points: first, that power can be restored in the face of considerable permanent limitation of elbow movement; second, that power does not return with free use even though the elbow movement is full, and, third, that in the great majority of cases power can be restored to 75 per cent or normal or better in an average of four to six weeks by resistance exercise.

In considering the mental aspect of rehabilitation Doran stated:

> It might be objected that resistance exercises are so localized that they concentrate the patient's attention too much upon his injury and that they are so dull that they will produce mental apathy. Such a viewpoint, however, overlooks the fact that the weakness of the limb is continually grasping the patient's attention in numerous ways through the day reminding him of his disability, especially his loss of muscular power.

Summary

Rehabilitation of injured patients requires prompt use of physical medicine, that is, coordinated physical, occupational and recreational therapy. This means establishment of rehabilitation departments in our American hospitals. A model for such departments is the rehabilitation clinic established in Boston by the Liberty Mutual Insurance Company, which handles a large volume of workmen's compensation.

Physical therapy—the use of heat, massage and exercise—should begin while the patient is still in bed.

Occupational therapy should be prescribed to suit the needs of the individual patient by a physician who has a thorough knowledge of physiology, pathology and bodily mechanics. It should be aimed not merely at improving the mental condition but at restoring the muscles which the patient uses in his regular occupation.

The chief object of recreational therapy is the social adjustment of the patient. This can often be accomplished by helping him to excel at a given form of recreation.

In the case of psychologically protracted convalescence, Solomon's method of psychiatric guidance in combination with physical and occupational therapy is advisable.

In planning the treatment of an injured worker in the curative workshop, the physician should keep in mind Griffiths' theory of the conditioned reflexes of industry and should direct the occupational therapy of the patient toward restoring that patient's particular work-conditioned reflex.

In the restoration of limb function after injury, active resistive exercises are more valuable than generalized, free-swinging exercises because they are localized and controlled.

(*Continued on page 570*)

SOME PHYSIOLOGIC EFFECTS OF PASSIVE AND ACTIVE EXERCISE *

I. The Cardiovascular Response to Graded Exercises

E. CORINNE FRIES, M.S.

MADISON, WISCONSIN

The literature regarding the physiologic effects of passive exercise is not extensive. It is generally believed that only active contractions of muscle against a load will produce an increase in strength. Passive exercise is employed clinically, not to develop muscle power, but to prevent fibrosis and to restore normal motion in a stiffened joint. The motion is thought to relieve stasis and edema by assisting venous return and increasing the lymph flow from the part.[1-3] There is almost no experimetal evidence as to whether or not passive movements can produce any change within muscle or as to whether they do have any demonstrable influence on the circulation.

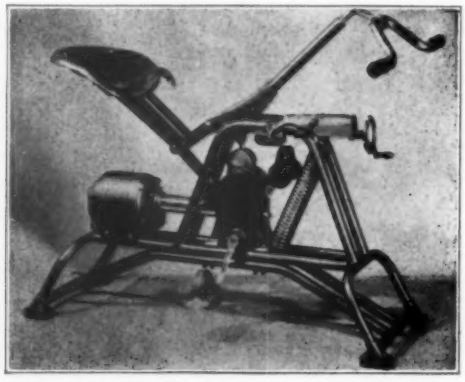


Fig. 1. — The electrically driven bicycle ergometer used in the experiments. The handlebars are in the position of "full extension."

A motor-driven bicycle ergometer (fig. 1) was made available to this laboratory, whereby it was possible to administer passive and active exercise simultaneously to different body parts of the same subject. The various maneuvers that could be executed on the machine had previously been classified as to difficulty by Steinhaus and his associates on the basis of the skill and coordination involved.[4] The work cost of some of the same exercises had been measured previously in terms of increased oxygen consumption at the Laboratory of Aero-Medicine of the Mayo Clinic.[5] The subjective "difficulty scores" did not agree entirely with the experimental results as to metabolic cost of the activity performed. The purpose of this study was to appraise the severity of a graded series of passive and active exercises by determining the subject's cardiovascular response to the work done. It was felt that such observations would permit the establishment of a convenient physiologic classification of these combined passive and active movements in terms which are commonly understood in relation to purely voluntary muscular effort.

Method

The subjects were two women aged 22 and 31 (PVK and ECF). Both had had professional training in physical education and were accustomed to vigorous activity.

* From the Department of Physiology, Mount Holyoke College, and the Section of Physical Medicine, University of Wisconsin.

At the time of the experiment neither had engaged in strenuous exercise for some months, nor had either had any previous experience with the apparatus.

The machine was geared in such a way that all parts moved simultaneously. The handlebars rose up and back as the saddle glided up and forward to meet them, this movement being followed by a descending forward movement of the bars as the seat swung back and down. Thus the trunk and arms were alternately approximated and separated at a rate of 45 times per minute while the feet were being driven around by the pedals at 90 revolutions per minute. The exercise could be simplified by disengaging the pedals and allowing the feet to remain stationary while the rest of the body was in motion. The bars could be placed in three different degrees of extension, which made it possible to vary widely the amount of stretch afforded by the movement of the bars and seat away from each other. The motion of the legs was passive at all times, as resistance against the pedals would arrest the motor. The

Circulatory Response of Two Normal Subjects to Ten Minutes of Different Grades of Passive and Active Exercise *

	Exercise †	Subject	Stabilization Recumbent ‡			Sitting at Rest §			Postexercise Sitting ‖			Recovery Recumbent †				Calory Inc. (¶)
			HR	BP	PP	HR	BP	PP	HR	BP	PP	HR	BP	PP	Time	
1.	PASSIVE	PVK	64	98/57	41	76	100/66	34	84	102/70	32	64	99/62	37	71#	2.3
	Pedals idle		68	95/56	39	84	104/64	40	86	105/66	39	69	97/57	40	9	.....
	Bars in neutral															1.6
		ECF	64	106/68	38	76	104/68	36	68	106/62	44	64	106/62	44	47	.....
2.	ACTIVE	PVK	68	109/58	51	88	88/56	32	96	110/74	36	68	104/60	44	14	.....
	Pedals idle															4.4
	Bars in mid-extension	ECF	60	114/73	41	68	110/72	38	84	136/68	42	61	114/73	41	71	.....
	Part. resistance															
3.	PASSIVE	PVK	64	110/60	50	96	97/60	37	92	100/56	44	64	105/58	47	33	3.6
	Pedals engaged															2.4
	Bars in neutral	ECF	72	108/58	50	76	106/68	38	84	110/68	42	72	108/68	40	36	.....
4.	ACTIVE	PVK	63	100/60	40	84	93/64	29	96	118/68	50	68	100/60	40	114	.....
	Pedals engaged															5.3
	Bars in full extension	ECF	60	100/57	43	84	102/66	36	108	118/62	56	64	112/70	42	57	.....
	Partial resistance															
5.	ACTIVE	PVK	60	98/59	39	88	100/80	20	100	120/68	52	60	99/60	39	90	.....
	Free pedalling															
	Bars in full Extension	ECF	56	108/58	40	76	102/72	30	88	120/76	44	63	108/68	40	12	.....
	Elbows straight															
6.	ACTIVE	PVK	72	98/58	40	88	106/60	46	112	118/56	62	80	98/58	40	82	.....
	Pedals engaged															
	Part. resistance	ECF	48	108/69	39	64	106/76	30	100	126/60	66	62	108/70	38	72	.....
	Hands at mid bar															
7.	PASSIVE	PVK	72	100/58	42	76	111/68	43	98	125/68	57**	72	102/60	42	85	.....
	Feet on bars															3.2
	Bars in full Extension	ECF	68	110/70	40	72	108/74	34	80	118/72	46	68	110/67	43	18	.....
8.	HEAVY WORK	PVK	60	102/60	42	68	110/72	39	124	141/68	73	80	99/59	40	111	.....
	Pedals engaged															11.2
	Bars in full extension	ECF	69	110/69	41	88	116/78	38	156	142/72	70	83	119/71	48	72	.....
	Strong assistance															

* HR indicates heart rate, BP blood pressure and PP pulse pressure.
† Listed in order of difficulty.
‡ Average of last five readings (at minute intervals).
§ Last reading after five minutes of sitting on bicycle at rest.
‖ Reading taken first minute post exercise.
¶ Calory increase with exercise over control sitting rate. 5. (Refers to Bibliography in Boothby Reference.)
# Stethoscope too tight.
** Ridden with partial resistance.

* This study was supported in part by Human Engineering Associates, Summit, N. J., who furnished the exercycle. The work was done in the Department of Physiology and Section of Physical Medicine at the University of Wisconsin.

active exercise was limited to the arms, shoulders, and supporting trunk muscles with the subject either resisting or assisting the movement of the handlebars. "Partial resistance" was accomplished by using only two fingers to resist the pull of the machine.

Observations were made of a series of eight exercises ranging from mild passive activity to heavy work. These are presented in order of difficulty in the accompanying table. As far as possible, the exercises were performed at the same time of day, about an hour after a light luncheon. The subject was stabilized in the recumbent position until a series of three to five constant heart rate and blood pressure readings, taken at minute intervals, had been obtained. The preliminary stabilization was usually prolonged over a period of from thirty to forty minutes. The subject then mounted the bicycle and sat at rest for five minutes while the circulatory observations were continued, after which the motor was started and the machine ridden for ten minutes. The subject remained in position on the apparatus, and the first postexercise reading was taken within thirty to sixty seconds after the motor was stopped. The remainder of the postexercise recovery was followed minute to minute with the subject recumbent.

In order to evaluate any effects that might be due to a familiarity with the device and with each specific exercise, circulatory records were made on PVK only on alternate days, the subject being allowed to practice each new exercise for ten minutes on the day preceding the observation. At the end of the series, PVK repeated the first mild exercise to determine whether or not this amount of training would cause any marked change in circulatory response. This made a total of seventeen rides for the nine experiments recorded. To assess further the influence training might have on the pattern of circulatory changes with exercise, the second subject (ECF) worked with PVK, performing each exercise two successive days for ten minutes. At the end of this seventeen day training period, circulatory readings were made on ECF while she performed each of the eight test exercises in reverse order for eight consecutive days. It was assumed that if the character of the circulatory adjustments remained the same for each subject under these varied conditions of practice, the response could be considered to be a true reflection of the inherent demands of the exercise on the circulatory system of the organism.

Results and Their Interpretation

The analysis of the data must necessarily be limited to a presentation of general trends, because (1) it was not possible to measure objectively the amount of work done by each subject and (2) the absolute degree of difficulty of the exercises varied with the two subjects owing to the fact that the machine could not be adjusted to fit differences in body build. The table summarizes the circulatory effects of the exercises for both subjects. Figure 2, a graphic representation of the percentage variation of the postexercise heart rate and systolic pressure from the sitting resting values, shows that the response to each exercise was remarkably similar in the two subjects. Passive motion caused essentially no general vasomotor adjustment. Active exercise, consisting of exerting "partial resistance" to the movement of the machine, demanded approximately the same degree of adaptation regardless of the type of activity performed, while vigorous assistive work, "hard exercise," induced extensive circulatory changes in both subjects. The consistency in the pattern of response in the two subjects, particularly regarding the contrast between the exercise of partial resistance and hard active work, suggests that the adaptation of the circulation is related directly to the amount of active work performed.

The histograms demonstrate that merely to sit and ride the bicycle induced practically no alteration in the circulation immediately after the activity. The apparent exception in the case of exercise 7 (riding with the feet on the bars) for PVK is due to the fact that the subject resisted the motion of the handlebars and hence presented a record typical of "active" work. The response of ECF shows that, even when completely passive, this exercise may cause slightly more circulatory adjustment than occurs in the other two exercises. This may be due to two factors, (1) that the

position called forth more muscles for the maintenance of balance and (2) that with the feet at the level of the heart the effects of gravity would be eliminated and the position would tend to raise the heart rate and blood pressure quite apart from any direct reflex adaptations to activity. This rise, however, is well below 15 per cent of the resting sitting rate, which is less than any of the increases accompanying voluntary exercise.

Among the records for the activities of "partial resistance" only one

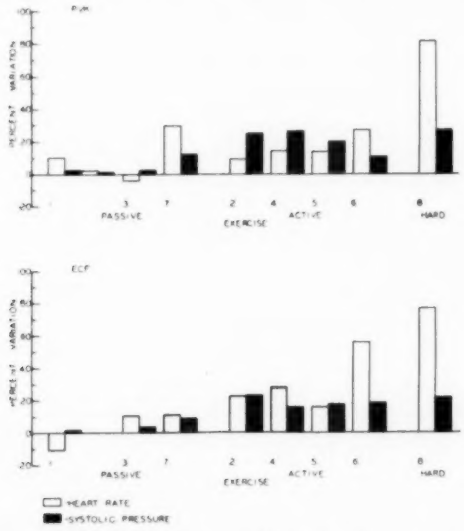


Fig. 2. — Percentage variation in heart rate and systolic blood pressure from resting sitting values in response to ten minutes of passive and active exercise of graded severity.

varied from the general pattern of results. This was exercise 6 for subject ECF. It was observed that on this day the subject's basal heart rate was much lower than on any of the other days (48 vs. 60 or above). The subject had had little sleep the previous night. It is suggested that the subject's circulatory mechanism was particularly labile for that day and that the response might be considered as atypical. This "atypical" record does not distort the general trend of the data, as the extent of the adjustments here still fail to equal those produced in the exercise accompanied by vigorous voluntary effort (No. 8, fig. 2).

In the last exercise, that of hard work, the subjects actively assisted the movement of the bars with the maximum effort they could sustain for the ten minute test period. The graph demonstrates that this effort evoked the most striking circulatory changes of any of the exercises, both as to the increase in heart rate and as to elevation of systolic blood pressure. The table shows that the recovery period was greatly prolonged, with the heart rate remaining well above the resting level when postexercise observations were brought to a close an hour after the cessation of activity. Such a response is typical of hard, anaerobic work.

These results parallel those obtained previously by Boothby in the energy studies at the Mayo Clinic. Dill[6] has established standards for the classification of activity on the basis of metabolic cost. According to his criteria, the passive exercise performed here would be considered moderate activity. The increase in oxygen consumption was only two to three times that of control values, and the changes in heart rate and blood pressure were negligible. With the superimposition of active resistance, the metabolic

cost of the activity rose to that of moderately hard work, while the relatively severe exercise augmented the energy cost to the range of maximal or anaerobic work, with the calory consumption mounting to eleven and two-tenths times the resting level and the cardiovascular adjustments becoming sharply enhanced.

The one exercise that seemed to exhibit the greatest difference between skill and work cost rating was exercise 7 (passive riding with the feet on the bars), which was performed passively by ECF and elicited no significant vascular response. The skill grading of high difficulty was probably based on the awkwardness of the position, which would not make it an easy one for an unskilled subject to perform. Undoubtedly, the work cost values of these exercises would vary with an individual's motor ability. In this study the two subjects were above average in coordination and training. Further objective measures of the difficulty of the exercise should be established on subjects with little exercise experience and on individuals judged to have a low "physical fitness" or with demonstrable cardiovascular disturbances.

Other exercise studies on normal, untrained subjects, patients with cardiac disease and those convalescing from illness indicate that the type of response to exercise is strikingly similar in all cases, the differences lying in the quantity of work performed to induce excessive circulatory readjustments.[7-11] Thus it would appear that the pattern of response to the selected exercises studied might be relatively the same in all individuals and that the variations in circulatory response between patients and normal subjects for one of them would reflect the proportionate degree of changes that could be expected for any of the others. The objective grading of these exercises on the basis of cardiovascular response of normal subjects could, then, serve as an indication of the relative severity of the exercise. The response of a patient to any one of these activities would indicate the limit of performance of that individual, and the type and degree of exercises could be assigned on the basis of the reactive efficiency of the subject's vasomotor mechanisms.

It was somewhat surprising to observe that it is possible to administer rapid, almost violent, passive exercise to a subject without the appearance of general circulatory changes in the immediate postexercise period. Centrifugal force alone would seem to be enough to cause some alteration in the blood flow through the part. If this occurred, a reflection of these local variations would be expected to be evident in the general circulatory response. The postexercise readings were taken within the first minute after the cessation of activity. It may be that in these normal subjects the recovery was too rapid to catch any evanescent circulatory changes that might have been present during passive exercise. That this type of activity has no significant effect on the normal circulatory apparatus is borne out further by the fact that the characteristic "active" work changes were the same in the two subjects with and without the pedals in gear and the feet in motion. It would be interesting to determine what effect this violent passive movement might have on debilitated, untrained and cardiac patients. The works of MacKenzie[12] and of Lewis[13] emphasize the importance of maintaining, as far as possible, a normal regimen for patients with some cardiac deficiency. One difficulty has been to find a means of establishing the amount and kind of activity the patient can tolerate. It would seem that exercise of this nature, combining the necessary elements of pleasantness, convenience and adaptability, should be very useful in the administration of exercise to the cardiac patient. Likewise, other patients in need of carefully controlled exer-

cis could be rehabilitated with an activity regimen graduated to fit their individual work capacity.

Summary

The cardiovascular response of two normal young adult women to a graded series of exercises on an electrically driven stationary bicycle ergometer has been reported. The machine has the unique feature of exercising the upper and lower extremities simultaneously along with the large supporting trunk muscles. The exercises may vary from ones that are completely passive to those of hard muscular work. The results are compared with homologous data showing the increase in metabolic cost with exercise.

The data indicate that:

1. The circulatory adjustment of the individual to a given exercise on the motor-driven bicycle ergometer offers an objective method of defining the severity of the work done.

2. Exercises can be performed on this machine which range from a mild passive type, involving no circulatory stress, to those of heavy muscular work, causing vascular adjustments paralleling those of anaerobic activity.

3. The rapid leg motion, as incited passively by the machine, exerts little or no effect on the general circulatory mechanism.

References

1. Kovács, R.: Electrotherapy and Light Therapy, Philadelphia, Lea & Febiger Co., 1942, chap. 24.

2. Krusen, F. H.: Physical Medicine, Philadelphia, W. B. Saunders & Co., 1941, chap. 14.

3. Mennell, J. B.: Physical Treatment by Movement, Manipulation and Massage, Philadelphia, Blakiston Co., 1940.

4. Snyder, B.: Personal communication to the author.

5. Boothby, W. M.: Personal communication to the author.

6. Dill, D. B.: The Economy of Muscular Exercise, Physiol. Rev. **16**:263 (April) 1936.

7. Gemmill, C.; Booth, W., and Pocock, B.: Muscular Training: I. The Physiological Effect of Daily Repetition of the Same Amount of Light Muscular Work, Am. J. Physiol. **92**:253 (Feb.) 1930.

8. Proger, S. H., and Korth, C.: Effect of Light Muscular Training on Patients with Heart Disease, Arch. Int. Med. **55**:204 (Feb.) 1935.

9. Nielsen, H. E.: Clinical Investigations Into the Cardiac Output of Patients with Compensated Heart Disease During Rest and During Muscular Work, Acta med. Scandinav. **91**:223, 1937.

10. Abramson, D. I.; Fierst, S. M., and Flachs, K.: Effect of Muscular Exercise Upon the Peripheral Circulation in Patients with Valvular Heart Disease, J. Clin. Investigation **21**:747 (Nov.) 1942.

11. Simonson, E., and Enzer, N.: Physiology of Muscular Exercise and Fatigue in Disease, Medicine **21**:345 (Dec.) 1942.

12. MacKenzie, J.: Diseases of the Heart, London, Oxford University Press, 1918.

13. Lewis, Thomas: Diseases of the Heart, New York, Macmillan Co., 1933.

I am greatly indebted to Dr. Frances A. Hellebrandt for her direction and advice throughout the study. Appreciation is also due to Peggy V. King for her assistance as subject and operator in the experiments reported.

SOME PHYSIOLOGIC EFFECTS OF PASSIVE AND ACTIVE EXERCISE *

II. Training Effects on the Strength of Specific Muscle Groups

E. CORINNE FRIES, M.S.

MADISON, WISCONSIN

The first paper of this series[1] described an electrically driven bicycle ergometer whereby it is possible to administer graded exercises ranging from those which are entirely passive to those involving hard active work. The device offers certain unique attributes for exercise studies, as it is possible to superimpose hard active work for the upper extremities on the motor-driven motion of the machine and at the same time have the legs continue their rapid passive rotatory movements. Thus, the relative effects of passive and active exercise may be compared directly in the same subject. This study was designed to demonstrate some of the differences in the local response of a body part to passive motion and active muscular contraction. The effects of daily training on the ergocycle on the strength of specific muscle groups are discussed in this paper.

Methods

The subjects were 11 normal healthy young adult women ranging in age from 20 to 41 years. They had either had professional training in physical education or were members of the Women's Army Corps of the Army age in motor skill and physical efficiency. A brief exercise history of each subject is presented in table 1.

The subjects rode the bicyle ten minutes daily for 21 consecutive days, performing the exercises as listed in table 2. The bout was arranged to offer a variety of selected active exercises for the upper extremities. At the beginning of training some modifications had to be introduced until the subjects became accustomed to the machine, but by the end of the tenth day all were following the assigned routine. In engaging the pedals, the subject would throw a greater stretch on one leg or the other according to the way in which the foot rhythm coincided with the upswing of the saddle. This stress was alternated from one leg to the other for each ride.

The pre-training and post-training strength of the muscle groups listed in table 1 were determined by means of a modified Martin strength test[2] which measured the individual's power to resist actively a smooth, steady motor-driven pull. This method could not be applied readily to two of the muscle groups studied: the knee flexors, which were tested by hand according to Martin's original procedure,[3] and the abdominal muscles, for which the dynanometric Wisconsin method as described by Hamer was used.[4]

Results and Interpretations

Table 2 shows each subject's percentage change from the control values in the strength of specific muscle groups after training. In order to minimize errors due to sampling and the variability of the subject the data were grouped and evaluated statistically by the method for small samples (table 3).[5] The critical ratios show a markedly significant increase in strength of the abdominal, shoulder and knee extensor groups, with a slightly less, though of the United States. Thus the group was well trained and above the aver- still significant, improvement in the power of the hip extensors.

* From the Department of Physiology, Mount Holyoke College, and the Section of Physical Medicine, University of Wisconsin.

TABLE 1. — *Percentage Difference in Muscle Strength of 11 Subjects After Twenty-One Days' Training on a Motor-Driven Bicycle Ergometer.*

Subject	Age, Years Height, Inches	Exercise History	Shoulders: Protractors %	Shoulders: Retractors %	Elbow: Extensors %	Elbow: Flexors %	Knee: Extensors %	Knee: Flexors %	Hip Extensors %	Abdomen %	Total %	Muscle Soreness *
1. M. M.	32 64½	Little activity now; formerly much; physical education major	+7.7	+9.1	—18.6	—27.3	0.0	.....	—22.4	+29.7	—5.8	Serratus and quadriceps
2. L. P.	24 60¼	W. A. C.; activity moderate	+32.0	+42.1	+9.9	—9.1	+27.0	+32.8	+32.6	+57.1	+31.7	Quadriceps, abdominals, arms and shoulders
3. M. W.	26 62	W. A. C.; Lieutenant; likes sports; little activity now	+12.2	+5.7	+5.9	+14.5	+43.0	.....	+62.9	+12.5	+24.9	Quadriceps, back, shoulders; this subject had the most soreness
4. H. A.	40 66	W. A. C.; moderate activity	+35.6	+16.7	+5.0	+29.0	+23.0	+36.2	+57.5	+62.5	+17.1	Glutei (saddle sore), hamstrings
5. G. P.	37 66	W. A. C.; only necessary activity	+131.0	+73.5	—8.8	+90.5	+67.8	+30.2	+129.8	+77.1	+86.0	No soreness
6. A. K.	22 70	Only moderately active now; physical therapy technician	+16.5	+25.3	0.0	—8.2	+5.0	.....	+29.4	+22.9	+16.7	Quadriceps, arms, shoulders, back and adductors
7. D. K.	20 63	Very active	—2.0	+45.5	—12.5	—1.7	—7.7	—17.3	—4.0	+97.3	+6.9	Quadriceps and pectorals
8. H. E.	41 68¼	W. A. C.; only moderately active now; former physical education teacher	+2.6	+108.5	+11.1	+37.2	+36.0	+10.0	+24.1	+97.6	+37.9	Quadriceps, back and elbow extensors
9. H. S.	27 66	Very active; physical education teacher	+0.8	+8.1	+2.9	—14.3	—9.8	—14.0	—25.5	+33.3	—8.5	No soreness
10. M. A. K.	21 53	Very active; physical education major	+50.8	+40.0	+6.3	+27.5	+71.8	+13.8	+15.9	+72.2	+34.8	Quadriceps, abdominals, back and shoulders
11. E. M. H.	21 64	W. A. C.; only moderately active	+20.8	—1.0	+30.8	0.0	+20.5	+41.1	+38.4	0.0	+19.2	Shoulders and Adductors

* Muscle soreness was reported in the first three days of training.

TABLE 2. — *Training Bout Performed Daily for Twenty-One Consecutive Days by 11 Normal Subjects on a Motor-Driven Bicycle Ergometer.**

Order of Exercises	†Type of Activity	Description of Exercise	Time, Seconds
1	Passive	Subject sits on the motor-driven machine and rides without resistance; handlebars in "normal" position	60
2	Active	Subject actively assists the movement of the bars; the bars are placed in the following successive positions:	
		(*a*) Bars over	60
		(*b*) Bars turned	60
		(*c*) Bars in full extension	60
3	Passive	Subject rides with the hands behind her back	60
4	Passive	Subject rides with no resistance, hand on bars and elbows straight; bars in full extension	60
5	Active	Alternated turning of the bars:	
		(*a*) Turn with every second swing forward of the seat	60
		(*b*) Turn with every forward swing of seat; bars in full extension	60
6	Passive	Subject sits with the hands on her knees	30
7	Active	Primarily for abdominals; arms straight, no resistance; bars in normal position	60
8	Active	Strong assistive movements with bars; bars in "normal" position	60

* Total riding time, ten minutes.
† Pedals were engaged throughout.

TABLE 3. — *The Influence of a Battery of Combined Passive and Active Exercises on the Strength of Specific Muscle Groups of 11 Normal Subjects.*

Muscle Groups	Pretraining *			Posttraining *			CR†
	*M	SD	V	M	SD	V	
	Pounds	Pounds	%	Pounds	Pounds	%	
Shoulder —							
Protractors	114.5	26.91	14.79	139.5	15.84	11.34	8.80
Retractors	110.7	31.80	28.72	142.2	35.40	24.89	7.06
Elbow —							
Flexors	82.6	18.47	22.36	87.9	12.57	14.30	2.49
Extensors	37.4	8.00	21.29	37.4	8.49	22.70	0.00
Hip —							
Extensors	193.4	78.30	40.44	227.9	43.70	14.79	4.23
Knee —							
Extensors	91.2	20.35	22.31	110.8	15.36	13.84	8.48
Flexors	76.4	24.52	32.09	84.8	13.34	15.73	2.40
Abdominals	80.9	19.16	23.68	121.1	28.50	23.53	12.60
Total	766.3	172.40	22.49	928.9	92.40	9.94	9.05

* M indicates mean; SD, standard deviation; V, variability.
† CR indicates critical ratio.

The most marked gain in strength was attained by the abdominal muscles. This group was employed actively throughout the entire ten minutes of the riding period for the maintenance of equilibrium, and in addition certain exercises, such as No. 7, placed a specific demand on the abdominal muscles to elicit strong supporting contractions. Thus the group which received the greatest amount of active training was that which demonstrated the greatest increase in strength. The voluntary exercises were all selected to cause strong active contractions of the muscles of the upper extremities. The high positive difference in shoulder strength before and after the exercise period verified the theoretic presumption that the development of functional efficiency in muscle is related directly to the amount of work done by that muscle. The hip and knee extensors, notably the hamstrings and quadriceps muscles, appeared to have a more active role to sustain balance than was anticipated. The exercises, particularly those numbered 2*c*, 4 and 5 (table 2), invoked strong stabilizing contractions which served to produce the significant increases in the strength observed in these groups.

From the critical ratios it may be assumed that the elbow flexors and extensors did not aid the shoulder muscles in the performance of the rowing movements with the handle bars, as these groups showed no significant change in strength. This was not wholly within expectations but might be taken as indicative of the subject's previous exercise experience. They were all trained persons and had learned to use their shoulder muscles for hard, sustained pushing and pulling movements with the upper extremities. The results would seem to confirm the thesis that well coordinated persons use the large protractors and retractors of the shoulder for powerful arm actions where endurance rather than skill is required.

Of the muscles tested, those which most nearly approached true passive activity were the knee flexors. These showed no significant alteration in strength, though the knee was made to flex rapidly throughout the exercise period at the rate of ninety times a minute or nine hundred a day. This supports the belief that passive exercise alone will not serve to augment significantly the contractile power of skeletal muscle.

From the testimony of each subject (table 1) it was noted that in general the muscle groups that demonstrated the most marked improvement were those which the trainees reported as being "stiff and sore" during the first few days of the rides. The exceptions, however, which are evidenced here are not fully explained by this small sample of data. Few subjects complained of any tenderness in the abdominal muscles, yet these were the muscles which manifested the largest and most consistent improvement. This musculature was not used in a similar manner to any great extent outside of the training bout. The subjects, then, might not have noticed the stiffness here above that present in the other groups which were employed more frequently in their daily activities. Subject 7, who exhibited the most marked percentage increase in strength as a result of training, reported no muscle stiffness at any time. On the other hand, a highly trained subject who reported no discomfort also showed no change in her strength score at the end of the twenty-one day practice period. In the remaining 9 subjects, of the twenty-three muscle groups reported as being painful, 18 demonstrated a concomitant increase in strength. The seeming relationship between muscle soreness and increase in strength suggests that there may be some parallel between this and the "overload" principle for the production of a functional muscular hypertrophy.[6]

Summary

Eleven healthy, normal young women performed a bout of combined active and passive exercise on a motor-driven bicycle ergometer ten minutes daily for twenty-one consecutive days. Specific muscle groups were tested by means of a modified Martin strength test before and after training. The data suggest that:

1. A short period of systematized daily training on a motor-driven bicycle ergometer will produce a demonstrable increase in muscle strength in those groups which are made to develop active tension during exercise. In this study strong voluntary contractions of the shoulder and abdominal muscles were superimposed on passive motion of the general body musculature. The subsequent augmentation in contractile power as a result of training was found to be limited primarily to these two groups which received active exercise.

2. In these trained, well coordinated subjects the flexors and extensors of the elbow joint were little employed to perform the strong arm move-

(*Continued on page 570*)

DIAGNOSTIC AND THERAPEUTIC MASSAGE

HAROLD D. STORMS, M.D.

TORONTO

Massage is frequently prescribed without full appreciation of its special indications. A physician may order it because he can think of nothing else and feels that it will at least occupy the patient's mind and time. He may prescribe it with the idea that massage is soothing; and indeed gentle friction of the skin does have a soporific effect, though this is not a therapeutic one. Or he may employ it to improve the circulation or even to stimulate lymph flow. The circulation, however, can be altered more readily by diathermy and by active or passive muscle movements.

My own belief is that the proper use of massage is in the detection and relief of muscle spasm. In a certain narrow field it has both diagnostic and therapeutic value.

There is a tendency among physicians to neglect the muscular system. They have learned the origins and insertions of the muscles, but little about their function, and they fail to a large extent to take them into consideration in diagnosis and therapy. Even in cases of sprains and similar injuries the tendency is to think of the bones, ligaments, nerves and bursae. Yet it is the muscles about a joint which preserve its integrity and are the main structures injured when the joint is injured, either through direct trauma or through indirect trauma in their effort to limit an abnormal movement by passive forces.

Consider how the physical trainer treats the athlete with a "charlie horse." He does not take a history and search for a focus of infection. Nor does he mutter academically about fibrositis, sinovial tear, bursitis, and so forth, and of the necessity for rest. Instead he feels around with knowing fingers, finds the spasm in the affected muscle and promptly kneads it out—and not with soothing massage, for he is not there to soothe but to get the player back in the game. His technic is far from soothing, but it is efficacious.

This picture may seem to have little connection with private practice. Yet the case of the injured athlete is not unrelated to that of the housewife with self-diagnosed neuritis of the arm who finds it difficult to abduct her arm sufficiently so that she can do her hair; of the banker, an occasional golfer, who is sure he has sciatica; of the office clerk who has headaches that start at the occiput, go over the top of the head and settle over the eyes; of the patient, young or old, who has recurring pain in the back which he thinks is due to sacroiliac strain or disease; and of the woman over 30 who has painful feet. Such patients present medical problems the solution of which the medical profession has side-stepped because it has preferred to think in terms of test tubes, microscopes, roentgen ray, diet and rest and has neglected the best tools in the professional kit—the hands. Both the injured athlete and the patients listed have suffered muscle damage, and this needs diagnosis by palpation and direct treatment by massage.

In examining this statement it would be well to consider what is meant by muscle damage and its clinical sign, which is spasm. A healthy muscle has a large built-in safety factor. It can stand strain and can contract with a pull many times that demanded by ordinary use. But if it is made to contract with greater strength or is subjected to a passive pull greater than

it is equipped to stand, some of its fibers tear. Pain, swelling and the other signs of inflammation of the muscle are produced. The entire muscle or part of it goes into spasm. This is painful and lasts for hours, days, weeks, months or years. If it remains for a long period, the bit of muscle involved destroys part of its substance by its continuous contracting, and there is replacement by scar tissue. Hence the fibrosis of the muscle, which is not an acute process but the result of chronic spasm.

The part played by infection with absorption is in decreasing the safety factor of all the muscles so that they sprain more easily. Thus it is possible for a patient to have flat painful feet as a result of chronic abscess of a tooth, because the muscles whose work it is to preserve the arches of the feet have not been able to sustain a strain normal muscles would have carried without trouble.

Sprains are less common among athletes than among other persons, because the latter are not in as good health and their muscles are weaker. In such persons, however, a sprain may not be apparent from the history, because it may have been caused by an activity which the patient considers trivial. The importance of diagnosis by palpation is apparent. Once the sprain is located, the patient may remember that a few months—or a few years—ago he felt some pain in the back or shoulder while changing a tire or, in the case of a woman, while moving trunks in the attic, and that this lasted a day or two. The point is that at the time of the first sprain the spasm lasted long enough to damage the muscle and a subsequent even more trivial strain started the symptoms again.

It should be remembered that the spasm can at any time be felt by the examining fingers and that it is the direct cause of the pain for which the patient is seeking relief. It should be detected by palpation and treated at once, while search for a hidden infection, which may be the underlying cause of the sprain, proceeds by the usual methods.

Distinguishing between normal and abnormal soft tissue when exerting deep pressure with the examining fingers or thumbs is an art that can be attained by practice. It is an extremely valuable accomplishment in which every practitioner of physical medicine should be expert. It has a threefold value: It enables the physician to ascertain, first, whether or not massage is to be given and, second, just what area in the arm, leg, back, shoulder or neck needs the massage (the spasm may be a very small one, perhaps only the size of a 10 cent piece). Third, it reassures the patient that the operator knows what he is about to do. In our clinic we never ask a new patient where his pain is. It is difficult for most patients to localize the point of pain either by pointing or by description, and we consider it much better to locate it ourselves. Many patients who are sent in as having sacroiliac trouble are found to have a sprain of one of the erector spinae muscles; many with "neuritis of the arm" or "bursitis" have a simple sprain of the supraspinatus or trapezius muscle. And many a patient who has been labeled neurotic or a malingerer, no cause having been found for the complaint of pain, is actually overjoyed, sometimes pathetically so, when a tender spasm that could be the reason for the distress is demonstrated. An assurance that the correction of the condition is easy is the first step in obtaining cooperation.

The massage is preceded by diathermy or the application of infra-red rays if the condition is acute and so requires light massage. It is followed by these if the condition is chronic and the kneading must be forceful and deep and there will consequently be a certain amount of after-pain.

There are many kinds of massage strokes. If I were to mention them

all it would be but to dismiss most of them, for I believe that the kneading stroke and occasionally some firm effleurage are all that are necessary. Even in the case of an acutely swollen, sprained ankle, firm, slow effleurage is called for to milk fluid out of tissues and engorged veins; light stroking would only irritate.

The word massage comes through the French from the Greek μάσσειν, meaning to knead. The kneading stroke is the basis of massage, and, in fact, one could treat most of the patients who require massage with this stroke alone. But this stroke, or any other, will fail unless one has made a diagnosis of the condition of the underlying tissues and knows the location, size and depth of the spasm.

In the kneading of the spasm, the cushions of the finger tips, or the ball of the thumb, do not slide over the skin; instead they hold position on the skin, the short stroke being made possible by the loose connective tissues. The procedure, thus, is not a rubbing, and there is no necessity for a lubricant. A little powder is used to keep the skin dry. The direction of the kneading stroke is always parallel to the muscle fibers, never across, so as to keep the discomfort to the patient at a minimum, and the power of the stroke is adjusted to the patient's tolerance.

One of the commonest causes of failure in massage is the maintenance of the treatment for too long a time. As soon as one feels the spasm begin to soften, the massage should be stopped for that day. Otherwise the spasm may tighten up, not to soften again during the treatment, and produce more pain perhaps than the patient had at the beginning of the treatment.

For an art that requires manual skill got by practice, one can in a short article mention only a few of the points of technic and can convey an impression only of the critical judgment necessary to its proper exhibition. But I cannot say too strongly that the specialist in physical medicine who cannot massage his own patient if the occasion or the patient demands, who is missing the satisfaction of getting under his own expert hands the condition that requires treatment, who cannot criticize or train his own technicians in the exact treatment he wants given, is depriving himself of a very large part of his function.

GRADING OF SPASM IN INFANTILE PARALYSIS

J. WAYNE McFARLAND, M.D.*

and

DOROTHY A. GRAVES, B.E., R.P.T.T.**

LOS ANGELES

The purpose of this paper is to present a method of grading muscle spasm in the disease infantile paralysis.

Soon after the Los Angeles County General Hospital commenced using the Kenny treatment for infantile paralysis, it became apparent that some scheme of grading muscle spasm was necessary in order that the physician might have a graphic picture of the patient's progress from week to week and be able to determine how rapidly the range of motion returned to normal after the initial symptoms had developed.

The amount of spasm present is recorded on entry of the patient to the hospital, and two weeks later an examination is made to determine the increase or decrease of spasm and muscle tightness. Follow-up examinations are made thereafter at three to four weeks intervals.

Although the plan of examination with the schematic drawings was made primarily for the recording of the acute muscle spasm, which we have found present in all of some 900 cases, we have found that the same method can be used in the subacute and chronic stages of the disease and the result record as tightness or contracture. It is not intended that this shall take the place of proper visual examination; rather we have found the following scheme a satisfactory way of functionally grading spasm (fig. 1).

In the examination the movements are all performed passively, the range of motion being noted and the amount of spasm present in the muscles or muscle groups recorded as very severe, or + + + +, to slight, or +. An example of + + + + spasm would be the neck pulled into extreme extension, as shown in the section "Spasm of Posterior Neck Muscle." When the head can be flexed on the chest the spasm is graded normal, or 0.

Back spasm is graded with the legs straight and also with the legs flexed, as shown in "Spasm of Erector Spinae Muscle."† Limitation of the back flexors may be present owing to pain and tightness of the hamstrings when the legs are extended. This is ruled out by having the patient flex the knees, thus relaxing the pull of the hamstrings on the pelvis. It is to be noted that forward flexion takes place in the spine and not at the hip joints. For example, if with the legs flexed the patient can sit up straight, but on attempting to flex the spine farther so as to touch his head to his knees he "overshoots" his knees, then obviously spasm or tightness of the back has not been released. The spine in such cases remains straight as the patient bends forward, and the movement occurs largely at the hip joint and not in the spine.

The exact area of back spasm in acute poliomyelitis, or tightness in the later stages, can best be detected by having the patient sit in a good light facing the examiner, as shown in figure 2. In this position flatness and

* From the Department of Therapeutics, College of Medical Evangelists, and the Contagious Disease Section of the Los Angeles County General Hospital.

** Technician in charge of Kenny treatment in Contagious Disease Section of Los Angeles County General Hospital.

† It is understood that in the term "erector spinae muscle" the various muscle groups of the sacrospinalis muscle are included.

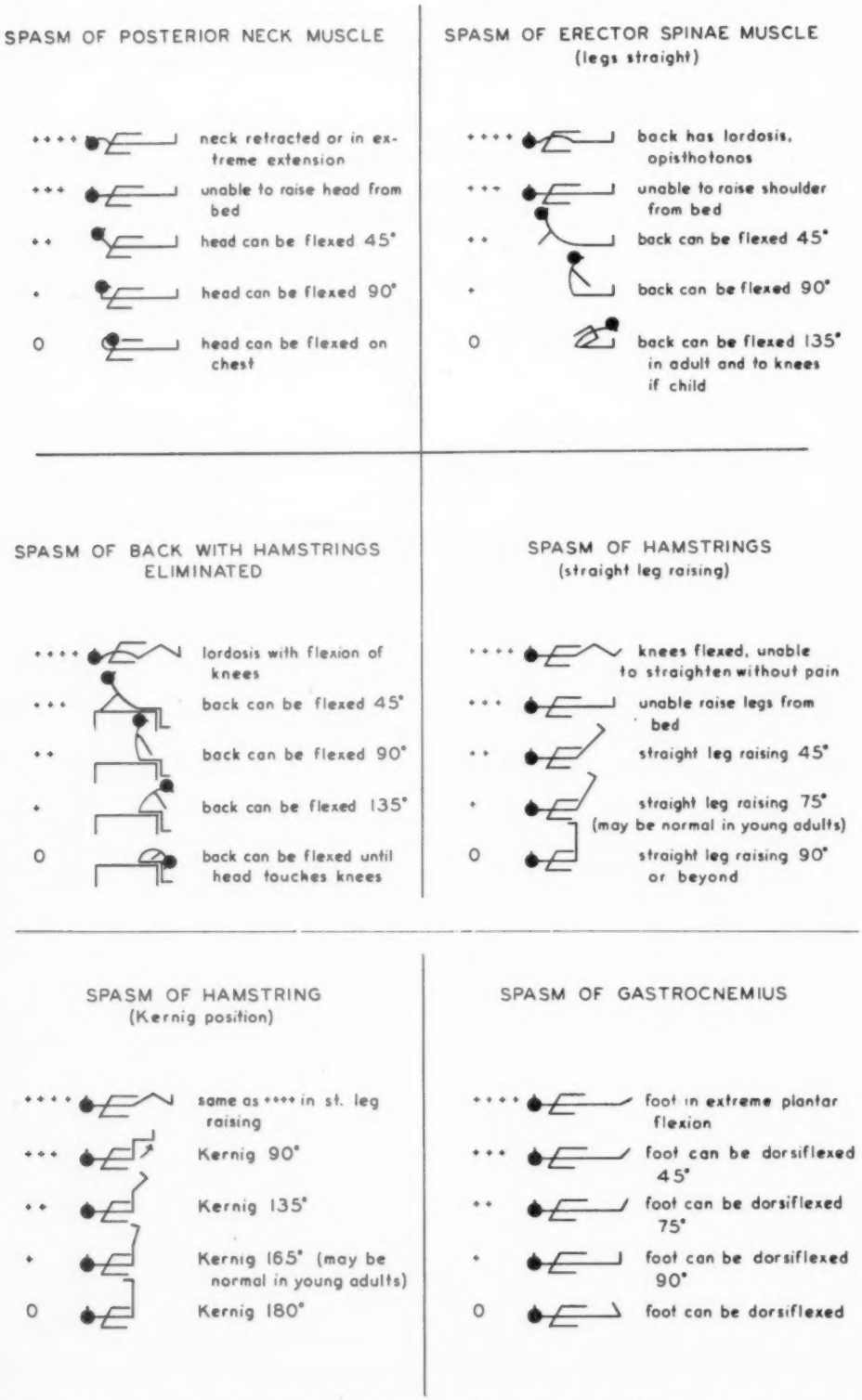

SPASM OF POSTERIOR NECK MUSCLE
++++ neck retracted or in extreme extension
+++ unable to raise head from bed
++ head can be flexed 45°
+ head can be flexed 90°
0 head can be flexed on chest
SPASM OF ERECTOR SPINAE MUSCLE (legs straight)
++++ back has lordosis, opisthotonos
+++ unable to raise shoulder from bed
++ back can be flexed 45°
+ back can be flexed 90°
0 back can be flexed 135° in adult and to knees if child
SPASM OF BACK WITH HAMSTRINGS ELIMINATED
++++ lordosis with flexion of knees
+++ back can be flexed 45°
++ back can be flexed 90°
+ back can be flexed 135°
0 back can be flexed until head touches knees
SPASM OF HAMSTRINGS (straight leg raising)
++++ knees flexed, unable to straighten without pain
+++ unable raise legs from bed
++ straight leg raising 45°
+ straight leg raising 75° (may be normal in young adults)
0 straight leg raising 90° or beyond
SPASM OF HAMSTRING (Kernig position)
++++ same as ++++ in st. leg raising
+++ Kernig 90°
++ Kernig 135°
+ Kernig 165° (may be normal in young adults)
0 Kernig 180°
SPASM OF GASTROCNEMIUS
++++ foot in extreme plantar flexion
+++ foot can be dorsiflexed 45°
++ foot can be dorsiflexed 75°
+ foot can be dorsiflexed 90°
0 foot can be dorsiflexed

Fig. 1. — Spasm Gradations: very severe, + + + +; severe, + + +; moderate, + +; slight, +; none, or normal, 0. This scheme covers the muscles found most frequently involved in spasm.

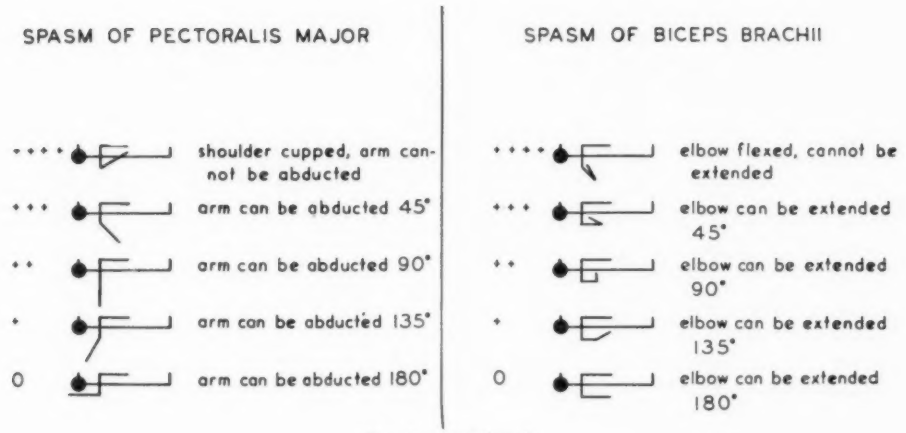

SPASM OF PECTORALIS MAJOR
shoulder cupped, arm cannot be abducted
arm can be abducted 45°
arm can be abducted 90°
arm can be abducted 135°
arm can be abducted 180°
SPASM OF BICEPS BRACHII
elbow flexed, cannot be extended
elbow can be extended 45°
elbow can be extended 90°
elbow can be extended 135°
elbow can be extended 180°

Fig. 1. — Continued.

tightness in various segments of the erector spinae muscle groups can be seen when they would be overlooked if the back were viewed posteriorly. Detection of spasm in the back muscles is important, and the spasm frequently is unilateral. It is on the side with spasm that flatness and tight-

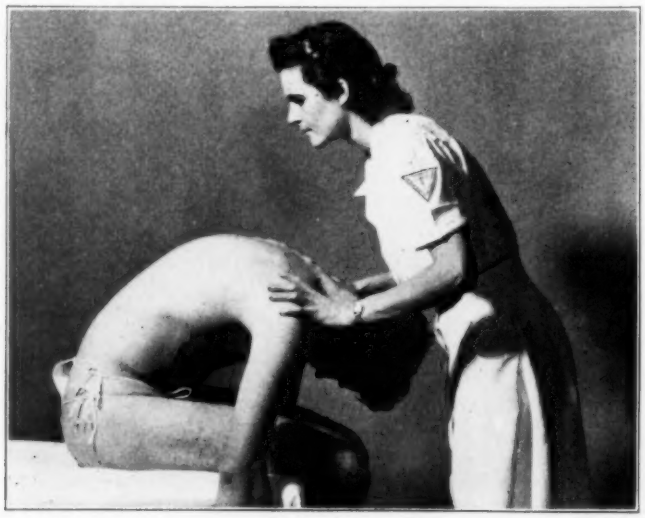


Fig. 2. — Detection of Back Spasm: For the detection of local areas of muscle spasm or muscle tightness, the patient sits with the back flexed facing the observer.

ness are going to occur and produce the concavity of a scoliosis. In the very acute case the erector spinae muscles that are in spasm will actually be larger and more swollen than those on the normal side. Within a few days, however, the muscle masses become smaller and flatter. They are the areas which require constant packing and muscle reeducation to prevent contractures.

Spasm of the hamstrings is best determined with the patient in the Kernig position, as shown in figure 1. Straight leg raising is also used in grading such spasm. Methods for grading spasm of the gastrocnemius, pectoralis and biceps muscles have been included.

Summary

A simple method of recording muscle spasm in the acute stage of infantile paralysis and the degree of tightness or contracture present in the subacute and chronic stages of the disease has been presented.

It is apparent that the charts do not cover all the muscles or muscle groups in which spasm occurs. They have served rather as a guide in determining the amount of spasm present in the muscles most frequently affected and have given us a means of recording the progress of the release of this spasm from week to week.

It is not intended that this method shall take the place of goniometer readings or of minute muscle analysis, but for all practical purposes it works out as a convenient and easy method of recording spasm in the groups of muscles most frequently affected in the acute stage of poliomyelitis.

AWARDS OR MERIT BY THE AMERICAN CONGRESS OF PHYSICAL THERAPY FOR THE YEAR 1944

In Recognition of distinguished contributions to the medical science of physical medicine, Gold Key awards were made to two outstanding persons by the American Congress of Physical Therapy. Dr. Herman L. Kretschmer of Chicago and Dr. Frank H. Krusen of Rochester, Minnesota, were granted these awards.

The awards were announced at the 23rd annual banquet of the American Congress of Physical Therapy held at the Hotel Statler in Cleveland, Thursday evening, September 7. Major Ora L. Huddleston made the presentation of keys.

Dr. Kretschmer is urologist on the staffs of Presbyterian and Children's Memorial hospitals and clinical professor of genitourinary surgery at Rush Medical College, Chicago. He is president of the American Medical Association.

Dr. Krusen, director of the Baruch committee on physical medicine, is head of the section on physical medicine of the Mayo Clinic, Rochester, Minn., and professor of physical medicine at the Mayo Foundation, University of Minnesota.

ARCHIVES of PHYSICAL THERAPY

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

.·. EDITORIALS .·.

A MEMORABLE ANNUAL MEETING

The 23rd annual convention of the American Congress of Physical Therapy, held at the Hotel Statler, Cleveland, from September 6th to 9th, 1944, has been the most important and most successful meeting the Association held in recent years, and its impact should mark a new era in the history of physical medicine in the United States. Several factors contributed to the success of this meeting: the well planned and well executed program, the important decisions reached, the enthusiastic attendance and the active participation of national leaders in civilian and military medicine and in humanitarian work. The implications of the recent report of the Baruch Committee on Physical Medicine, and the expectation of many momentous advances to come in education, research and clinical application played a large role in creating an atmosphere of happy optimism and dignity.

At the formal opening of the congress a cordial welcome was extended by the leaders of medicine in the state of Ohio: by Dr. Abraham B. Bruner on behalf of the Cleveland Academy of Medicine, and by Dr. Norman Hoerr on behalf of the Western Reserve School of Medicine. Official greetings from our sister organizations across the Atlantic, the newly formed British Association of Physical Medicine, were read by the secretary and received great applause. Dr. Miland E. Knapp, being installed as president of the congress, made an inspiring address on the Education of the Medical Student in Physical Therapy; Senior Surgeon Dean A. Clark, Medical Director, Division Vocational Rehabilitation Federal Security Agency, U. S. P. H. S., spoke on Physical Restoration in Vocational Rehabilitation and Captain Howard M. Montgomery, of the Office of Rehabilitation of the Bureau of Medicine and Surgery of the Navy, spoke on Rehabilitation in the Navy. The high spot of the evening was an address by Basil O'Connor, the new president of the American Red Cross, and for many years president of the National Foundation for Infantile Paralysis, on the work of the National Foundation, initiating and carrying on research and treatment in poliomyelitis and promoting in recent years the closely allied field of physical medicine. Mr. O'Connor stated that the Foundation has spent about thirty million dollars over a period of eleven years for this work. This sum has been voluntarily contributed by the people of the United States, demonstrating vividly how in an enlightened civilization, scientific research is being supported by the masses. All these addresses will be printed in successive issues of the ARCHIVES.

Consideration for the various aspects of rehabilitation of the injured in the armed forces and among the industrial workers formed a large part of the program of the scientific sessions of the congress. Some fourteen papers on this subject were contributed by officers of the Army, Navy, Veterans Administration and leaders in civilian rehabilitation. There were also sev-

eral practical demonstrations on this topic at the meeting and on institutional rounds. The presentation of clinical and research studies on poliomyelitis formed another large part of the proceedings. The seven papers on this subject also contained some pathfinding studies in muscle innervation, on electrical reactions in denervated skeletal muscles, on the effects of heat and cold on motor end plates in skeletal muscles, all of which have important bearings on the conception and treatment of the other motor nerve disturbances. Among the other new and interesting subjects presented were the physical basis of ultraviolet air disinfection, treatment of peripheral vascular conditions and of causalgic states, medical physics, mineral water and spa therapy, the malpractice problem, the need for a more uniform terminology.

The last evening's session was largely devoted to presentation of plans and future aspects of physical medicine such as the functions of a center for research and instruction, and the recommendations of the Baruch Committee Dr. Ernest J. Jacqua, Educational Director of the Committee, made an eloquent address urging that medicine take its rightful place of leadership in the program of human rehabilitation. The total number of papers presented at the general scientific session was 45. These sessions were well conducted, starting and ending on time; the discussions were concise and to the point. The attendance throughout the meeting was excellent. The total registration was approximately 500.

The program of the three day instruction course held in conjunction with the congress, presented as a new feature, a number of lectures and demonstrations on the fundamental aspects of physical medicine in addition to those on clinical application. The course was well attended and its present form should prove a constantly more popular and instructive part of the programs of future sessions.

The technical exhibits contained some twenty exhibits showing a number of new apparatus and other devices, medicinal agents, books and periodicals. The exhibitors were greatly pleased by the constant interest shown in their demonstrations and the many requests made for new apparatus. With the release of essential materials many manufacturers expect to get back to production within a few months to satisfy the ever increasing civilian needs.

The annual business of the congress was transacted in two sessions. The reports of the committees showed constant progress. It was decided that in the future all committee reports should be presented in writing four weeks in advance of the meeting so as to be ready for early publication. The finances of the congress were in the same progressively prosperous state as during the preceding three years. The most important decision reached at the business sessions was the change of the name of the congress to that of the *American Congress of Physical Medicine* and the change of the name of the ARCHIVES to that of the *Archives of Physical Medicine*. This decision is in keeping with the newer concepts of the scope of our work, in including the therapeutic as well as the diagnostic utilization of physical agents. In the same spirit at the annual session of the American Society of Physical Therapy Physicians, held in conjunction with the congress, a committee was appointed to find a new one word term for specialists in physical medicine. The adoption of such a term would do much to add dignity to the physicians practicing physical medicine and clear up the confusion caused by the fact that technicians are also generally being designated as physical therapists. Some forty new members were admitted to the congress at the meeting.

A colorful highmark of the annual session was the congress dinner, attended by the record number of 263 members and guests. In keeping with the spirit of a war time meeting, the roll of the honored guests and speakers included some of the highest ranking medical officers of the United States and its Allies. Among them were Rear Admiral Luther Sheldon, Jr., Surgeon General, Bureau of Medicine and Surgery, Navy Department; Major General David Grant, U. S. Army, Air Surgeon, U. S. Army Air Forces; Major General George F. Lull, U. S. Army Deputy Surgeon General, War Department; Colonel English, Chief of Rehabilitation of Canadian Army, Ottawa, Canada; Group Captain Daley, Royal Australian Air Forces; Lieutenant Colonel Harold Storms, Royal Canadian Army, Medical Corps; Colonel Howard Rusk, Chief of Convalescent Rehabilitation, U. S. Army Air Forces; Senior Surgeon Dean A. Clark, Medical Director, Vocational Rehabilitation Federal Security Agency, U. S. P. H. S.; Major Charles Brooke, Chief of Rehabilitation of U. S. Veterans Administration; Captain Charles S. Behrens, Chief of Division of Radiology, National Naval Medical Center, Bethesda, Md.; Captain A. R. Sweeney, U. S. P. H. S., Medical Officer in Charge U. S. Marine Hospital, Cleveland; Colonel Robert Hardin, Commanding Officer, Crile General Hospital, U. S. Army; and others. It was an amusing episode in the proceedings of the evening when the toastmaster, President Knapp reported that his six year old little girl, seeing the galaxy of uniforms, exclaimed, "Mother, look at all the sergeants." The audience was greatly inspired by the simple eloquence and the many impressive facts of the addresses of the three guest speakers, Admiral Sheldon and Generals Grant and Lull, all reporting the remarkable success of the medical work of the U. S. Army and Navy. Two of these addresses are published in this issue of the ARCHIVES.

Part of the proceedings of the dinner evening was the awarding of the annual gold keys in recognition of the outstanding contributions in the field of physical medicine. Major Huddleston announced the two recipients, Dr. Herman Louis Kretschmer, Professor of Genitourinary Surgery at Rush Medical College, and President of the American Medical Association, and our own Frank H. Krusen, Chief of Section of Physical Medicine at Mayo Clinic and more recently, Director of the Baruch Committee on Physical Medicine. Dr. Krusen responded with his usual modesty extolling the work of his collaborators in the Baruch Committee's work.

The final afternoon of the meeting was given over to an instructive tour of hospital clinics of the Cleveland City Hospital, the Rehabilitation Center and at the Cleveland Clinic Foundation. It ended by a large social gathering on the high roof of the Cleveland Clinic enjoying the genial hospitality of Dr. Walter J. Zeiter, Director of Physical Therapy at the Clinic and Executive Director of the congress. The outstanding success of the Cleveland meeting was due, in a large measure, to the quiet efficiency of Dr. Zeiter as well as to the cordial teamwork developed in recent years throughout the congress.

New York City was chosen as the seat of next year's meeting and it will have quite a task to equal the spirit and the accomplishments of this year's memorable meeting.

GREETINGS FROM ACROSS THE ATLANTIC

British Association of Physical Medicine

11, Chandos Street, London, W. 1.

10th July, 1944.

Dr. Richard Kovacs,

American Congress of Physical Therapy,

New York.

Dear Dr. Kovacs:

The B. A. P. M. held its first Annual Meeting on Wednesday, June 21st. Lord Horder presided, and as Chairman of the Council, reported on the activities of the Association during the past year. He concluded by noting your kind feelings toward our Association.

Members were touched by the expressions of cordiality from their colleagues in the U. S. A. and desired that a message of good wishes be addressed to the American Congress of Physical Therapy at its Annual Meeting, coupled with the hope that the coming peace may see our two organizations side by side in the campaign against ill health.

Our Association looks forward with pleasurable anticipation to the friendly relationship and the fruitful collaboration which you outlined in your letter of January 22nd, 1944.

I enclose a list of the Council as at present constituted, and a copy of the Chairman's Report.

Lord Horder has asked me to add his personal good wishes for a successful meeting at Cleveland.

With kind regards, yours sincerely,

(Signed) PH. BAUWENS,

Hon. Secretary.

MEDICAL NEWS

Officers for 1945
American Congress of Physical Therapy

President
Miland E. Knapp, M.D.
Minneapolis

President-Elect
Walter S. McClellan, M.D.
Saratoga Springs, N. Y.

First Vice-President
**H. Worley Kendell*, M.D.
Chicago

Second Vice-President
**O. Leonard Huddleston*, M.D.
Denver, Colo.

Third Vice-President
Earl C. Elkins, M.D.
Rochester, Minnesota

Fourth Vice-President
Arthur L. Watkins, M.D.
Boston, Mass.

Fifth Vice-President
Robert L. Bennett, M.D.
Warm Springs, Ga.

Secretary
Richard Kovács, M.D.
New York

Treasurer
John S. Coulter, M.D.
Chicago

Executive Director
Walter J. Zeiter, M.D.
Cleveland

Executive Secretary
Marion G. Smith, B.Sc.
Chicago

* In Active Service.

Society of Physical Therapy Physicians
New Officers, 1945

President — Fred B. Moor, M.D., Los Angeles.

President-Elect — William D. Paul, M.D., Iowa City, Ia.

Vice-President — Earl C. Elkins, M.D., Rochester, Minn.

Secretary-Treasurer — Milton G. Schmitt, M.D., Chicago.

Membership Committee—Nathan H. Polmer, M.D., New Orleans; Miland E. Knapp, M.D., Minneapolis; Madge C. L. McGuinness, M.D., New York; Arthur L. Watkins, M.D., Boston; Robert L. Bennett, M.D., Warm Springs, Ga.

Program Committee—Albert A. Martucci, M.D., Philadelphia; Robert L. Bennett, M.D., Warm Springs, Ga.; Frank H. Krusen, M.D., Rochester, Minn.

Dr. Watkins Speaks on Physical Medicine

On August 10 at the U. S. Naval Construction Training Center, Quaddy Village, Dr. Arthur L. Watkins gave a clinic and lecture on physical medicine and rehabilitation. This talk was part of War Time Postgraduate Medical Meetings.

Physical Therapy Section
Southern Medical Association

St. Louis will be host this year to the thirty-eighth Annual Meeting of the Southern Medical Association, November 13, 14, 15 and 16, 1944. A program for the section on physical therapy which is being planned by the Chairman of the section, Dr. Emil J. C. Hildenbrand, Washington, will be held at the Jefferson Hotel, Wednesday morning, November 15, 1944 and will appear in full in the October issue of the ARCHIVES.

Dedication of Mason General Hospital

Major General Norman T. Kirk, Surgeon General of the U. S. Army, dedicated the Mason General Hospital, Brentwood, Long Island, New York, on June 22, 1944. The special school for training medical officers on neuropsychiatry has been located at this institution. The faculty of the school is directed by Colonel Wm. C. Porter, M.C. Colonel C. Odom, M.C., is the Command Officer at the hospital.

Plans Shaped for Army Medical History

At a meeting of representatives of the professional and administrative services of the office of the Surgeon General, held in Washington, plans were discussed and progress reports made on the medical history of the war. Work on the history has been in progress since August, 1941, under the direction of Colonel Albert G. Love, a veteran of nearly forty years service in the Army Medical Department. He was a member of the editorial staff that published the history of the Medical Department of the United States Army in World War I. Reports made at the recent meeting by officers responsible for historical volumes indicated that marked progress is being made in assembling information from medical installations in this country and overseas.

Editors have been selected for the volumes on the medical specialties and the administrative phases of the medical service. In addition to the research and editorial work to be done in the Office of the Surgeon General, historical activities will be carried forward by officers assigned to

headquarters of overseas theaters. They will secure, first-hand reports of the over-all medical services, particularly those rendered under combat conditions including evacuation of the wounded, the flow of supplies, and other problems. Officers in overseas theaters who have had extensive experience with medical and surgical problems peculiar to this war are being asked to record their observations for the history.

When first organized, historical activities of the Medical Department relative to professional subjects were part of a joint plan to be undertaken in cooperation with the Subcommittee on Historical Records of the Division of Medical Sciences of the National Research Council. The administrative and organizational volumes were to be prepared by the Medical Department. This plan, however, was modified recently in accordance with the wishes of Surgeon General Norman T. Kirk. General Kirk felt that the Medical Department should assume full responsibility for its entire history in view of the global scope of the work and the consequent necessity of having the history prepared by officers who have been intimately associated with the practice of military medicine throughout the world.

Medical histories were published by the Office of the Surgeon General following the Civil War and the first World War. The volumes have done much to perpetuate and disseminate professional, administrative and organizational medical advances developed under the impetus of war.

British authorities are carrying forward a similar plan for recording the medical history of the current war.

Fort Benjamin Harrison Station Hospital and Billings General Hospital Merge

The Surgeon General's Office announced the merging of the Fort Benjamin Harrison Station Hospital (Ft. Benjamin Harrison, Ind.) with the Billings General Hospital. The dispensary will be in charge of Major S. T. Sternberg, M.C., Billings Hospital will take care of dispensary cases requiring hospitalization which will be transferred to the jurisdiction of Colonel Harry L. Dale, M.C., Commanding Officer of the Billings Hospital.

To Aid War Effort, American College of Surgeons Cancels 1944 Clinical Congress

The American College of Surgeons, on action of its Board of Regents, has cancelled its Annual Clinical Congress because of the acute war situation that has developed, involving greater demands than at any time in the past upon our transportation systems for the carrying of wounded military personnel, troops, and war materiel. The Congress was to have been held in Chicago, October 24 to 27.

Illinois State Medical Society Announces Committee on Physical Therapy

Dr. John S. Coulter of Chicago has been appointed as Chairman of the Committee on Physical Therapy for the Illinois State Medical Society. The other members of this committee are: Dr. Milton Schmitt, Chicago; Dr. D. H. Levinthal, Chicago; Dr. Rudolph Mroz, Rockford; Dr. R. P. Peairs, Normal, and Dr. F. Flinn, Decatur.

Army Medical Department Observes 169th Anniversary

On July 27, the Army Medical Department observed the 169th anniversary of the establishment of the first medical service for the American Army. The Medical Department had its inception in the creation by the Continental Congress, July 27, 1775, of a hospital for the American forces shortly after George Washington assumed command in the Revolutionary War.

Among the letters of commendation received by Major General Norman T. Kirk, Surgeon General of the Army, were ones from Lt. General Brehon Somervell, Commanding General of the Army Service Forces and General Henry H. Arnold, Commanding General of the Army Air Forces.

General Somervell wrote:

The 169th birthday of the Medical Corps is one of which you, your immediate staff and all the officers, nurses and enlisted men of the Corps should be especially proud and I hope that you will accept for them and for yourself my very sincere contgratulations on a job most efficiently and bravely done.

On the combat fronts and at home, you have seen as I have, the superior performance of the Corps and have witnessed not only its splendid role in battle, but also its predominant part in recent medical development and experiment.

The admirable execution of the mission of the Medical Corps has earned the complete confidence of the country in a function of the Army which is naturally closest to the civilian consciousness.

We in the Army acknowledge and endorse that confidence, and in addition, add our personal congratulations and praise.

Brig. General Hillman Assumes Command of Letterman General Hospital on West Coast

Completing his work on his fifth anniversary as Chief of the Professional Service of the Office of the Surgeon General, Brigadier General Charles C. Hillman left Washington, to take up his new post as the Commanding General of Letterman General Hospial in San Francisco. This institution—containing 2,500 beds—has been designated as the principal debarkation hospital for casualties from the Pacific area.

Colonel Bleckwenn Appointed Neuropsychiatric Consultant

Colonel William J. Bleckwenn, Professor of Neuropsychiatry at the University of Wisconsin, has been appointed as the Neuropsychiatric Consultant to the Sixth Service Command with Headquarters in Chicago.

When Polio Strikes . . . Helpful Hints for Everyone

June through September is the season when infantile paralysis generally is on the upswing in the United States. The National Foundation for Infantile Paralysis has compiled the following suggestions which will be helpful to residents of areas where poliomyelitis is on the march.

1. During an outbreak of infantile paralysis be alert to any early signs of illness or changes in normal state of health, especially in children. Do not assume that a stomach upset with vomiting, constipation, diarrhea, severe headache or signs of a cold and fever are of no importance. These may be among the first symptoms of infantile paralysis. All children and adults sick with unexplained fever should be put to bed and isolated pending medical diagnosis.

2. Don't delay calling a physician. Expert medical care given early may prevent many of the crippling deformities. Proper care from the onset may mean the difference between a life of crippling and normal recovery.

3. Today there is no known prevention or protection against infantile paralysis. All that can be done is to provide the best possible care. Your doctor, your health officer and your local Chapter of The National Foundation for Infantile Paralysis can and will do everything in their power to see to it that your community is ready to meet an epidemic.

4. Observe these simple precautions:

(a) Avoid overtiring and extreme fatigue from strenuous exercise.

(b) Avoid sudden chilling such as would come from a plunge into extremely cold water on a very hot day.

(c) Pay careful attention to personal cleanliness, such as thorough hand washing before eating. Hygienic habits should always be observed.

(d) If possible avoid tonsil and adenoid operations during epidemics. Careful study has shown that such operations, when done during an epidemic, tend to increase the danger of contracting infantile paralysis in its most serious form.

(e) Use the purest milk and water you can. Keep flies away from food. While the exact means of spread of the disease is not known, contaminated water and milk are always dangerous and flies have repeatedly been shown to carry the infantile paralysis virus.

(f) Do not swim in polluted water.

(g) Maintain community sanitation at a high level at all times.

(h) Avoid all unnecessary contact with persons with any illness suspicious of infantile paralysis.

5. Don't become hysterical if cases do occur in your neighborhood. While infantile paralysis is communicable or catching during any outbreak, there are many who have such a slight infection that there are few or no symptoms. This large number of unrecognized infections is one of the reasons there is no practical way of preventing the spread of the disease. But it is also reassuring to know that, of the many persons who become infected, few develop serious illness and that, with good care, the majority who are stricken will make a satisfactory recovery. Remember that although this is a frightful disease, needless fear and panic only cause more trouble.

6. Attempts to stop the spread of the virus by closing places where people congregate have been uniformly unsuccessful. The resulting disturbance to community life is a disadvantage. Today there is no way by which the spread of infantile paralysis can be completely stopped.

7. There is no known cure for infantile paralysis. Good medical care will prevent or correct some deformities. But in about every fourth or fifth case there will be permanent paralysis that cannot be overcome. Do not believe those who for one reason or another promise to cure these cases. Be guided by sound medical advice if polio does strike in your family.

8. In almost all the counties of the United States there are local Chapters of The National Foundation for Infantile Paralysis prepared to help health officers, doctors, nurses, hospitals and patients in every way possible. These Chapters stand ready to assist the entire community. Know your Chapter—ask its help if needed—and volunteer to help your Chapter so that it will be able to render the necessary services. — (EDITOR'S NOTE: *This information in bulletin form has been sent gratis to more than* 500,000 *persons and organizations. The bulletin is also available in the following languages: German, Hungarian, Italian, Polish, Spanish and Yiddish. Copies can be obtained from the National Foundation's Health Education Service,* 120 *Broadway, New York* 5, *N. Y.*)

British Association of Physical Medicine

The British Association of Physical Medicine announces as members of its council for the period 1944-45 the following: Lord Horder, President; Dr. Francis Bach; Dr. L. D. Bailey, C.B., M.C.; Dr. P. Bauwens, Medical Secretary; Dr. W. Beaumont; Group Capt. J. F. Bromley; Dr. Hugh Burt; Dr. F. S. Cooksey, O.B.E.; Lieut. Col. Copeman; Dr. J. Cowan; Dr. E. J. Crisp; Lord Horder, G.C.V.O., Chairman; Brigadier F. D. Howitt, C.V.O.; Lieut. Col. Kersley; Dr. James Mennell; Lieut. Col. J. W. T. Patterson; Dr. M. B. Ray, D.S.O., Treasurer; Commander Sir Morton Smart, K.C.V.O., D.S.O., R.N.V.R., Vice-Chairman; Dr. Kenneth Stone; Major W. S. Tegner, and Sir Robert Stanton Woods.

Of the standing committees of the council, the Technical and Scientific Committee comprises Dr.

Beaumont, Dr. Cooksey, Dr. Stone, Major Tegner and the ex-officio members; the Educational Committee, Group Capt. Bromley, Dr. Burt, Dr. Mennell, Sir R. Stanton Woods and the ex-officio members, and the Policy Committee, Dr. Bach, Dr. Crisp, Sir Morton Smart, Colonel Patterson and the ex-officio members. The ex-officio members are the chairman, Lord Horder; the treasurer, Dr. M. B. Ray, and the medical secretary, Dr. P. Bauwens.

Lord Horder presented the first annual report (to June, 1944) as follows:

It is my duty, and pleasure, to record to you on behalf of the Council the work of our first year. You will, I am sure, not expect to hear of dramatic developments. Our task has been chiefly to lay the foundations on which we may build up an organization which will help to secure for physical medicine its rightful place in fostering the ideal of a healthy and vigorous community. The pursuit of that ideal should be the basis of all plans for reconstruction.

Our first task was the framing of a constitution. That has been drawn up in a form which I trust meets with your approval—a flexible form designed to provide for future development. It will be the task of the new year into which we are entering to seek the establishment, in every regional area under any new scheme of health services, of a group of our association promoting a more general appreciation of physical medicine in the achievement and maintenance of health and in the prevention and relief of disease.

One financial step taken was important —securing the approval by the Claims Department of the Inland Revenue of our association as a medico-educational charity. This will be of value in the future. We cannot, I regret to say, announce yet any such good fortune as the munificent gift of a million dollars with which Mr. Bernard Baruch has endowed our kindred body in the United States—the Congress of Physical Therapy. But we are at least in the position that generous donors and testators can help our cause with gifts free from taxation.

A fair beginning has been made with the organization of academic meetings and educational visits to such centers as the Army Convalescent Depot at Kingston. In the near future, when restrictions on travel imposed by the war and on accommodation for visitors have been relaxed, we shall endeavor widely to extend those activities.

These restrictions at present constitute a severe handicap. Nevertheless, it is clear to your Council that it was wise to disregard difficulties and launch our campaign at the time we did. The problems of medical education and medical organization for the future are pressing. They must be considered now so that plans may be ready for the peace period. It was urgent also that public opinion should be educated to recognize the degree of help which the right application of physical medicine can give to securing and maintaining wholesome standards for the community.

According to our British way of life public opinion is the governing factor: without its pressure, progress is tardy. We have to acknowledge with sincere thankfulness the great assistance which has been given to this part of our work by the medical and the lay press. The many important articles published have given to the majority of medical practitioners the opportunity of learning our aims. In due course we may expect this to be reflected in the growth of our membership.

In the matter of stressing the claims of physical medicine on the authorities responsible for the nation's system of training and of utilizing the healing services, your Council has not been dilatory, though little can be usefully said at present regarding negotiations and discussions now being carried on. The proposal of the two royal colleges to institute a diploma in physical medicine is a progressive step and is welcomed by your Council. Another proposal engaging the Council's attention is that sponsored by the Empire Rheumatism Council (which seeks the cooperation of other bodies) for the provision of short, intensive postgraduate courses to fit practitioners for what may be called junior appointments in hospitals and clinics dealing with crippling conditions, especially those arising from rheumatic disease.

To assist in the development of its work your Council has decided to appoint three standing committees dealing respectively with (1) policy, (2) education and (3) scientific and technical matters. These committees will consider questions referred to them and guide the full Council in making decisions thereon.

Financially, the modest subscription asked of our members—at present one hundred—has sufficed to carry on with the work of the year and to leave a credit balance of approximately £50. As our work extends—and it must greatly extend — financial needs will increase. To meet these needs we shall rely on the aid of those with good will and with the wisdom to judge that the relief of human suffering is the best of all charities.

Finally, your Council desires to record its appreciation, on behalf of the Association, of an expression of cordial reciprocity sent by Dr. Richard Kovacs of the American Congress of Physical Therapy.

BOOK REVIEWS

HEART DISEASE. By *Paul Dudley White*, M.D., Lecturer in Medicine, Harvard Medical School; Physician to the Massachusetts General Hospital. Third edition. Cloth. Pp. 1025, illustrated with 138 figures. Price, $9.00. New York. Macmillan Company, 1944.

The new edition of this outstanding text on heart disease continues the excellent features of previous editions plus the revisions necessitated by new knowledge. The subject matter is divided into four parts and is approached as is the patient. First, the cardiovascular examination; second, discussion of etiology; third, structural abnormalities; and fourth, functional disorders. Material presented for the first time in this edition includes a chapter on the range of the normal heart, sections on phonocardiography, ligations of patent ductus arteriosus, and splanchnic resection for hypertension. There are also new sections on military service, gastro-intestinal diseases, intracardiac thrombosis, pulmonary embolism and circulation of the blood.

The extensive but critically selected references remain an important feature and add weight to the authoritative statements of the author. Although succinctly and clearly written as befits a reference book, the style of writing is more that of the lecturer making reading attractively easy. This book should have a permanent place among the important works on heart disease.

ANNUAL REVIEW OF PHYSIOLOGY. Edited by *James Murray Luck*, Ph.D., Associate Professor of Biochemistry, Stanford University, Editor, and *Victor E. Hall*, M.D., Associate Professor of Physiology, Stanford University, Associate Editor, and twenty-three contributors of reviews. Cloth. Vol. 6. Pp. 630. No illustrations. Price, $5.00. Stanford University Post Office, California, Annual Reviews, Incorporated, 1944.

This 1944 volume of the Annual Review of Physiology is a welcome visitor to the reviewer's desk. Like its predecessors, it contains excellent résumés of important developments in the field of physiology covering periods of one to three years. On account of the war, most of the articles reviewed are taken from British and American literature; nevertheless, the bibliographies which accompany the chapters are extensive.

There is no branch of medicine in which a thorough knowledge of physiology is more important than in physical medicine. There is, therefore, no chapter in this volume which is not of interest to the specialist in this field, although some bear more directly on physical medicine than others. The chapter on the effects of heat and cold by Field and Hall, for example, is important since it reviews the literature on the influence of heat and cold on oxygen consumption, on temperature regulation, in hypothermia and in hyperthermia. Of these the section on temperature regulation is most important. Other chapters which have especial bearing on physical medicine are: one on tissue water and electrolyte by Darrow, one on physiologic psychology by Freeman and Watts and one on industrial physiology by Simonson. Freeman and Watts assert that the use of convulsant drugs for shock therapy has been largely abandoned for the "simpler and safer electrical method." Shock therapy by whatever method produced, however, is not entirely harmless, since definite though mild pathologic changes have been demonstrated in the brain following this procedure.

Other summaries in this volume are on neoplastic growth, energy metabolism, respiration, physiology of the skin, the digestive system, liver and bile, the kidney, the blood, the heart, conduction and synaptic transmission, visceral functions of the nervous system, vision, metabolism and endocrines and reproduction and its endocrine control. This sixth volume of the Annual Review of Physiology cannot be recommended too highly to all of those interested in this fundamental science which is one of the foundation stones of modern medicine.

MANAGEMENT OF THE COCOANUT GROVE BURNS AT THE MASSACHUSETTS GENERAL HOSPITAL. By *Joseph C. Aub*, M.D.; *Henry K. Beecher*, M.D.; *Bradford Cannon*, M.D.; *Stanley Cobb*, M.D.; *Oliver Cope*, M.D.; *N. W. Faxon*, M.D.; *Champ Lyons*, M.D.; *Tracy Mallory*, M.D., and *Richard Schatzki*, M.D., and their staff associates. Cloth. Pp. 158, 49 subjects in color on 8 plates and 64 illustrations in black and white. Price, $4.00. Philadelphia, London and Montreal: J. B. Lippincott Company, 1943.

The management of the burns received by thirty-nine patients in the Cocoanut Grove disaster is discussed in this monograph. Various workers from special fields described their contributions in the care of those injured, analyzed the shortcomings of the treatment and made recommendations for the treatment of burns and injuries and the handling of similar emergencies. Some of the problems discussed are hospital administration, social service activities, neuropsychiatry, sedation, pulmonary complications, treatment of surface burns and infections, chemotherapy for burns, physical therapy and rehabilitation after such injuries, shock complicated by pulmonary edema, the organization and the use of blood banks in such emergencies, thrombophlebitis, metabolic disturbances and the pathology of the various lesions which occurred.

Particularly challenging is the material on the social service activities, psychiatric problems and pulmonary complications. There seems to be little doubt that even in the most careful treatment of burns after such a disaster sufficient emphasis is not placed on these aspects.

No comparative studies of different types of treatment were made on the group of patients seen. Only the methods recommended by those concerned with the treatment of these patients were studied and the experiences and results of these recommendations were recorded. There is evidence that a great deal of thought and work was devoted to this study.

This monograph is an excellent report and it is of great practical value. Credit should be given to those who took this opportunity to make a real contribution to the care of the victims of such a catastrophe. The general practitioner, the military surgeon and the specialist can learn much from this detailed report.

VIRUS DISEASES IN MAN, ANIMAL AND PLANT. By *Gustav Seiffert.* Translation by *Marion Lee Taylor,* Ph.D. Cloth. Pp. 332. Price, $5.00. New York: Philosophical Library, Inc., 1944.

This volume is a survey of the major research work done on viruses during the last decade. The author admits that there are many gaps in our knowledge of the diseases caused by these agents. He has not attempted to fill them but has left them as open questions in the hope that they will stimulate further study.

The author defines virus as a disease stimulus, the nature of which is not known but which is characterized by very small size, close symbiosis with living cells, ability to propagate, production of typical similar diseases in unbroken series, affinity for certain specific cells, production of specific immunity and great capacity for variation.

After a brief history of the development of our present knowledge of the viruses and the virus diseases, the author discusses the properties of viruses including the morphology, the culture, the reaction to chemical and physical agents, the pathogenicity, the epidemiology and the production of immunity.

The discussions of the individual diseases caused by the viruses in plants, animals and man do not present the clinical manifestations but deal with characteristics of the individual agents, their morphology, their transmission and their production of immunity. Among the thirty or more human diseases caused by them, which the author has discussed, are such important ones as variola, measles, influenza, common cold, psittacosis, yellow fever, Hodgkin's disease, poliomyelitis, rabies and encephalitis lethargica. Among the important virus diseases of animals are hoof and mouth disease, distemper, cattle plague, hog cholera and encephalitis of horses.

In later sections of the book, the author discusses virus-like organisms such as rickettsia and bacteriophages as well as filtrable bacterial forms. The last section deals with methods of virus investigation such as the identification of elementary and inclusion corpuscles, methods of filtration and cultivation, and certain serological procedures. There is an extensive bibliography given in footnotes throughout the volume.

This work is a valuable summary of our present knowledge of the viruses and the diseases caused by them. It should be read by practicing physicians and veterinarians as well as any other workers interested in the clinical and laboratory aspects of these conditions.

CLINICS. Edited by *George Morris Piersol,* M.D., Professor of Medicine, Graduate School of Medicine, and Professor of Clinical Medicine, School of Medicine, University of Pennsylvania, Philadelphia, Pa. Vol. III, No. 1. Pp. 249. Price, $2.00. Philadelphia: J. B. Lippincott Company, Publishers, 1944.

The June *Clinics* contains a symposium on urology with many authoritative well-illustrated contributions, including an exhaustive and eminently practical article on "The Approach to and the Management of Syphilitic Patients," by Frederick Kalz, M.D., and L. P. Ereaux, M.D., Montreal, Canada. Among other original contributions are an interesting study on "Arteriosclerosis in the Young," a study of 372 autopsies with a report on six positive cases by James R. Lisa, M.D., and James Finlay Hart, M.D. of New York, and one on "Arteriosclerosis in Diabetes," by the same authors; another one is a study on "Granuloma Venereum: A Cause of Death—Report of Six Fatal Cases," by Edgar R. Pund, M.D., and George F. McInnes, Lt., M.C., U. S. N. R. The wide variety of topics and the practical approach to the subjects should make the *Clinics* valuable to all classes of physicians.

UROLOGICAL SURGERY. By *Austin Ingram Dodson,* M.D., F.A.C.S., Professor of Urology, University of Virginia. Cloth. Pp. 743 with 576 illustrations. Price, $10.00. St. Louis: The C. V. Mosby Company, 1944.

This book carries out the author's intention of producing a volume devoted to the surgical problems arising in everyday urologic practice. The author has made no effort to produce a complete treatise on urology but rather has written a book obviously based on his own experience and wealth of clinical material. It is written lucidly and is well supplied with graphically illustrative drawings and photographs. One has no difficulty in following his operative description, as both text and illustrations are well chosen and co-ordinated. The various surgical procedures described are those with which the author himself is acquainted and he has made no effort to include all known procedures referable to each urologic problem. There are adequate references to the latest work in urologic diagnosis and a particularly fine summary of the endocrinologic aspects of prostatic disease. The author wisely holds final judgment in abeyance and leaves it to the reader for the most part to judge for himself as to the validity of most of the present-day therapy.

There is an excellent discussion of acid-base balance and administration of fluid which is particularly impressive and lucid. Some urologists might consider that the author is overenthusiastic in his advocacy of intravenous urography as opposed to excretory pyelography in the chapter on excretory urography and cystography, although the point is well taken and supported. Important subjects such as anesthesia in urologic surgery, blood transfusion and radiation therapy are well covered and in adequate detail for a volume of this nature. Anatomic and physiologic relationships are emphasized in relation to the pathologic processes involved and to the surgical procedures described. The importance of proper preoperative and postoperative care is stressed and discussed.

This book is a fine contribution to the urologic literature and will prove of value to the practicing urologist as well as to the general surgeon who includes surgical urology in his practice. It also should prove of particular value to the intern and resident in urology by virtue of its scope and lucidness of presentation.

MINOR SURGERY. Edited by *Humphrey Rolleston*, and *Alan Moncrieff*. Cloth. Pp. 174, with illustrations. Price, $5.00. New York: Philosophical Library, 1944.

This book is made up of 18 chapters each one compiled by an authority in his particular field. All the work and the authors are from England. In the chapter on minor wounds by Cecil P. G. Wakeley the value of sulphonamides in minor wounds is discussed as well as punctured wounds and stabs and wounds of the fingers. G. R. Girdlestone, consulting orthopaedic surgeon, Radcliffe Infirmary, Oxford, contributes the chapter on sprains. The difference between the sprain of a joint and of a muscle is made clear, with its bearing on treatment, and examples are given. The value of early active movement is emphasized and explained. H. Lyon-Campbell Wood, Surgeon, King's College Hospital presents the chapter on the feet and recommends in some conditions the use of physical therapy. Many other chapters fall to a large extent within the province of general medical practice and while of interest to the general practitioner, hospital resident and surgeon may not be of too great interest to the physical therapy physician. Some of these are benign tumors and cysts, the genito-urinary system, non-operative treatment of hernia, the eye, the mouth, anaesthesia and analgesia. To the medical man in the armed forces the book should prove of value. Sir Alfred Webb-Johnson, President of the Royal College of Surgeons, England, has said about this book, "There are many points the practicing physician must bear constantly in mind when embarking on minor surgical procedures and he will be wise to read, mark and take to heart the sound advice contained in this book." The manner in which the book has been prepared recommends it as a useful book because it is compact, small in size, yet clearly and well arranged. It is highly recommended to those who are called on to do much or little minor surgery.

STOP WORRYING AND GET WELL. By *Edward Podolsky*, M.D. Pp. 124. Price, $2.00. New York: Bernard Ackerman, Inc., 1944.

The author of this little volume tells in 18 chapters in fairly popular language all the bodily troubles worry may cause, from skin eruptions to heart ailments, rheumatism and on to blindness. The last two chapters are devoted to an "anti-worry program" advocating a healthy mental approach to the program. The style of presentation is good, but at times there are too many medical terms used, which must be bewildering to the average layman. There are quotations from many clinicians. The printing and binding of the volume seem to show the results of wartime stress.

TEXTBOOK OF GYNECOLOGY. By *Emil Novak*, M.D., F.A.C.S., Associate in Gynecology, The Johns Hopkins Medical School; Gynecologist, Bon Secours and St. Agnes Hospitals, Baltimore. Second Edition. Cloth. Pp. 708. Price, $8.00. Baltimore: The Williams & Wilkins Company, 1944.

This is the second edition of a textbook originally named Gynecology and Female Endocrinology. It gives a well balanced, up-to-date and practical discussion by a competent authority, of the gynecologic problems encountered by the general practitioner. The 44 chapters of the volume begin with the traditional presentation of anatomy, embryology, and physiology, putting particular stress in the biologic and endocrinologic aspects, which have in recent years made such amazing progress. In the systematic consideration of the large number of gynecologic diseases the pathologic aspects received adequate treatment, but special stress is laid on functional disorders and on the full discussion of diagnosis and treatment. Surgical procedures are merely mentioned where they enter into the field of therapy; this is a welcome contrast to many textbooks where many pages are wasted on the detailed description of operative technic, of so little value to the average physician. Among the 456 illustrations many are color plates, adding to the vividness of presentation. Novak's volume should serve as a most desirable text for medical students and general practitioners, presenting all modern aspects of gynecology in a lucid and exhaustive manner.

PHYSICAL THERAPY ABSTRACTS

An Experimental Study of Different Methods of Artificial Respiration. A. Hemingway, and E. Neil.

Brit. M. J. **4355**:836 (June 24) 1944.

It is concluded that the rate of oxygen uptake and the cardiac output are usually greater with the rocking method than with the Schafer; the O_2 tension of the venous blood is higher.

The reasons for the differences in oxygen uptake with different methods of artificial respiration are not completely clarified. It would seem to be necessary to consider the following points: (a) Alterations in the tone of muscles due to stretch reflexes which would entail increased oxygen consumption. (b) If tissues are anoxic then increased oxygen supply to the part concerned might be followed by an increased uptake. (c) The higher rate of oxygen uptake with the rocking method than with Schafer's method may be due, in part, to the increased cardiac output.

The Schafer method should be immediately instituted when resuscitation is undertaken. No time should be lost while preparations are being made for the use of any other method.

The Effects of Mecholyl Iontophoresis and of Reflex Thermal Dilatation on the Cutaneous Blood Flow. Walter C. Randall, and Alrick B. Hertzman.

Am. Soc. Exper. Biol. **3**:38 (March) 1944.

The effects of mecholyl iontophoresis and of body heating on the cutaneous blood flow of the foerarm and leg were measured by photoelectric plethysmographs. Heat to the trunk resulted in profuse sweating and increased the flow 2.5 times in forearm skin and 3.5 times in leg skin. Cooling of the skin by evaporation probably prevented a maximal dilatation. Mecholyl iontophoresis increased the flow 5 times in forearm skin and 6.5 times in leg skin. The greater dilatation with mecholyl probably represents the maximal blood flow which can be provided in the skin at normal levels of blood pressure and therefore the maximum expansion of the cutaneous vascular bed. There is a question whether the so-called reflex thermal dilatation is entirely due to decreased vasomotor tone or importantly due as well to the direct effects of temperature on the vessels.

Evaluation of the Kenny Method in the Treatment of Chronic Infantile Paralysis. Burton Chance.

Pennsylvania M. J. **47**:978 (July) 1944.

The symptoms described in the concept exist. The deformities and disabilities which occur in chronic cases can be effectively treated if the cases are carefully selected because of specific symptoms. Poor results will be obtained if the cases are not well selected or if the physician and physical therapy technician are not well grounded in the knowledge of the concept. Complete prolonged paralysis of large muscular groups of antagonistic muscles will not be helped either by Kenny or any other type of physical therapy.

Surgery. Geo. H. Bunch.

South. Med. & Surg. **106**:259 (July) 1944.

Refrigeration is the anesthesia of choice for amputation on diabetic and senile patients. Another of its fields of usefulness is in the surgical care of the indigent down-and-outs who fill the charity wards of every large metropolitan hospital. In these institutions the clinical material is of sufficient volume to permit perfection of technic. In them special operating crews should be trained to work under refrigeration conditions.

Amputation With Refrigeration Anesthesia. Francis M. Massie.

South. M. J. **37**:5 (Jan.) 1944.

The numbing effect of cold has been known for centuries, but only in the past ten or twelve years have any serious studies been made of the effect of lowered temperatures on human sensation. The ice pack is replacing the hot pack in the treatment of acute fulminating infections of the extremities as it has already replaced heat in the treatment of lesions due to peripheral vascular disease.

With refrigeration, not freezing, tourniquets may safely be left on for many hours. Anesthesia produced by the combination of tourniquet and low temperature of the ice pack is complete. There is no shock during or following the amputation. Infection is completely controlled in the post-amputation stumps by continued cold packs, though there is experimental evidence that the tissues may be more suspectible to infection after the temperature is restored to normal. The experimental and clinical evidence emphasizes again the inexcusable menace of applying heat to any tissue with a reduced and inelastic blood supply. Traumatic cases reported by other observers point to a brilliant future for the application of cold to anemic and infected tissues.

Some Observations of Motion at the Shoulder Joint. Guy H. Fisk.

Canad. M. A. J. **50**:213 (March) 1944.

The author feels that a perusal of the current textbooks and recent articles on the shoulder joint leaves the reader with a confused impression of the process involved in the normal movements

of the shoulder. So much attention is given to the movement occurring at the scapulo-humeral joint that the reader gains the impression that the movements of the scapula, clavicle and the sternum are of no importance. Martin, for example, believes that the humerus is capable of rotating through 170 degrees at the scapulo-humeral joint. It is the purpose of the article to show that practically 50 per cent of the movement at the shoulder joint occurs as a result of the movements of the scapula and clavicle. The scapulo-humeral joint is thus responsible for only half the movement occurring at the shoulder. The movements of the bones forming the shoulder joint were elucidated by a study of the shoulder under a fluoroscope. Roentgenograms were taken in eight key positions to demonstrate all the points seen.

Polyneuritis of Unknown Etiology in Childhood. Alexander Hatoff.

J. Pediat. **24**:396 (April) 1944.

The author believes that it is practically impossible to evaluate properly the efficacy of any therapeutic measure in polyneuritis because of the tendency for spontaneous recovery in the average case. Numerous therapeutic measures have been reported in the literature. DeMello used vitamin B in his patient who was a 50-year-old male. Guillain recommends an intravenous infusion of sodium salicylate, 1 to 2 Gm., in serum with 10 per cent dextrose. He also suggests intravenous or intramuscular quinine, methanamine, or colloidal silver. Rubs with colloidal silver are said to be of value. Ionized iodine or calcium given by the transcerebromedullary route, warm baths, and irradiation are recommended on an empirical basis. Plugge used physical therapy and electrical stimulation with good results. Aring suggests that the Kenny treatment be given further trial. Removal of foci of infection is said to be of value in the immediate course of the disease.

Electromyography as a Method for Determination of Level of Lesions in the Spinal Cord. Paul F. A. Hoefer, and Samuel A. Guttman.

Arch. Neurol. & Psychiat. **51**:422 (May) 1944.

Fascicular twitching of muscles, with or without atrophy, may occur at the level of a lesion in the spinal cord when the corresponding region of the anterior horn or the motor roots are involved. Below the level of the lesion hyperactive reflexes and other signs of spasticity are usually present. Both types of signs may be studied by means of electromyography, but an investigation of the fasciculations appears to be of greater localizing value than a study of the abnormal phenomena which result from lesions of the long tracts.

Motor unit discharges recorded from relaxed muscles may indicate the level of a lesion of the spinal cord, even in the absence of clinical manifestations suggestive of involvement of the region of the anterior horn cells or the motor roots. In 17 of 24 cases the structural lesion was satisfactorily localized. The method is briefly described. In one additional case the localization by electromyography indicated a level one segment below the clinical level. In four cases motor unit discharges were obtainable over too many segments of the cord for precise localization. False localization were made in two cases.

Fatalities Associated With Electric Shock Treatment of Psychoses: Report of 2 Cases, With Autopsy Observations in 1 of Them. A. Gralnick.

Arch. Neurol. & Psychiat. **51**:397 (April) 1944.

Gralnick reports two deaths associated with electric shock treatment. The first patient died one week after her fourteenth treatment in a hyperpyretic state associated with status epilepticus; the second two days after his second treatment. No definite conclusion can be made with respect to the first case because of the absence of autopsy evidence. The acute nature of her death suggests some connection between the two events. It is possible that in this patient, as in a few of the cats studied by Alpers and Hughes, hemorrhages occurred in the hypothalamic region which were sufficient to cause the hyperpyrexia and status epilepticus. The fact that the patient died one week after her last treatment speaks against this possibility, but the exact time of occurrence of hemorrhage is not known. It is also possible that the current produced damage to the cells in the region of the already labile heat regulating center. These changes could have been associated with punctate hemorrhages and subsequent edema to produce the same result. Necropsy studies on the second patient disclosed evidence of cerebrovascular syphilis and other changes which were possibly due to the treatment itself. The alterations were not sufficient to account for death. The cause of death after electric shock treatment is still obscure. Electric treatment has attendant serious dangers and should not be given to patients with a history of vascular or cerebral disease.

Manual and Mechanical Resuscitation in Experimental Asphyxia. Bernhard Steinberg, and Albert Dietz.

J. Lab. & Clin. Med. **29**:701 (July) 1944.

Resuscitation with high percentage of oxygen administered in acute asphyxia by a mechanical device resulted in a more rapid return of oxygen content in the arterial blood than in manual resuscitation. Prolonged resuscitation with the mechanical device did not produce abnormal functional or tissue changes in animals. Inhalation of carbon dioxide and oxygen or resuscitation with oxygen and rebreathing of expired air with the mechanical device resulted in a rapid elimination of carbon monoxide. Mechanical resuscitation in acute asphyxia is a more efficient procedure than manual resuscitation.

A Rehabilitation Center for the Injured Worker — Coulter

(*Continued from page 539*)

References

1. Rehabilitation Council, quoted by Coulter, J. S.: Physical and Occupational Therapy in Rehabilitation, Arch. Phys. Therapy **24**:295 (May) 1943.

2. Black, S. Bruce: Personal communication to the author.

3. Aitken, A. P.: The Rehabilitation Center, Rhode Island M. J. **26**:286 (Dec.) 1943; Rehabilitation of the Industrial Casualty, Virginia M. Monthly **4**:177 (April) 1944

4. Hussey, R., in Occupational Therapy, J. S. Coulter, to be published.

5. Watkins, A.: Coordination of Physical and Occupational Therapy, Occup. Therapy **22**:115 (June) 1943.

6. An Outline of the Treatment of Fractures, Chicago, Am. Col. Surgeons, 1940.

7. Solomon, A. P.: Rehabilitation: Opportunities for Psychotherapy in Physical Therapy, Occup. Therap. **22**:286 (Dec.) 1943.

8. Griffiths, H. E.: Treatment of the Injured Workman, Lancet **1**:729 (June 12) 1943.

9. Doran, F. S. A.: The Problems and Principles of the Restoration of Limb Function Following Injury as Demonstrated by Humeral Shaft Fractures, Brit. J. Surg. **26**:351 (April) 1944.

Some Physiologic Effects of Passive and Active Exercise — Fries

(*Continued from page 549*)

ments; rather, the work was localized in the relatively more powerful protractors and retractors of the shoulder girdle.

3. The work of the muscles of the legs was seen to be not entirely passive, particularly in those groups which could aid in the maintenance of equilibrium.

4. The knee flexors, which were the most nearly representative of purely passive activity, did not exhibit a significant change in strength with training.

5. Nothing in this study indicates whether this rapid rise in muscle power due to voluntary exercise was not benefited by the fact that it was accompanied by the inciting stimulus of rhythmic and varied passive activity.

6. It is suggested that there might have been a physiologic relationship between the incidence of muscle soreness during training and the subsequent increase in muscle strength.

References

1. Fries, E. C.: Some Physiologic Effects of Passive and Active Exercise. I. The Cardiovascular Response to Graded Exercises, Arch. Phys. Therapy **25**:540 (Sept.) 1944.

2. Hellebrandt,, F. A.; Nelson, B. G., and Larsen, E. M.: The Eccentricity of Standing and Its Cause, Am. J. Physiol. **140**:205 (Nov.) 1943.

3. Lovett, R. W., and Martin, E. G.: Certain Aspects of Infantile Paralysis, J. A. M. A. **46**:729 (March 4) 1916.

4. Hamer, M. C.: Dysmenorrhea and Its Relation to Abdominal Strength as Tested by the Wisconsin Method, Res. Quart. **44**:229 (March) 1933.

5. Dunn, H. L.: Application of Statistical Methods in Physiology, Physiol. Rev. **9**:275 (April) 1929.

6. Steinhaus, A. H.: Chronic Effects of Exercise, Physiol. Rev. **13**:103 (Jan.) 1933.

I wish to acknowledge the assistance received throughout this study from Dr. Frances A. Hellebrandt, of the Section of Physical Medicine of the Wisconsin General Hospital, Madison, Wis. Appreciation is due also to the six members of the Women's Army Corps of the Army of the United States and the five civilians for their perseverence and cooperation as subjects for these experiments.